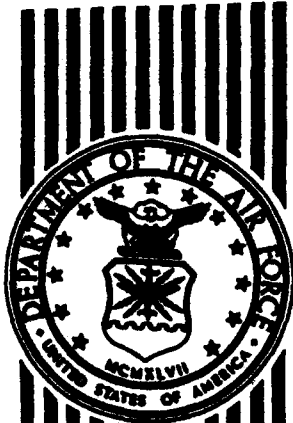


AD-A221 060



SUBSTITUTION OF WAX AND GREASE CLEANERS WITH BIO- DEGRADABLE SOLVENTS: PHASE I, PART III

P.M. WIKOFF, R.K. SCHOVER, T.L. HARRIS,
D.F. SUCIU, R.E. McATEE, G.S. CARPENTER,
P.A. PRYFOGLE, J.M. BELLER

EG&G IDAHO, INC.
P. O. BOX 1625
IDAHO FALLS ID 83415

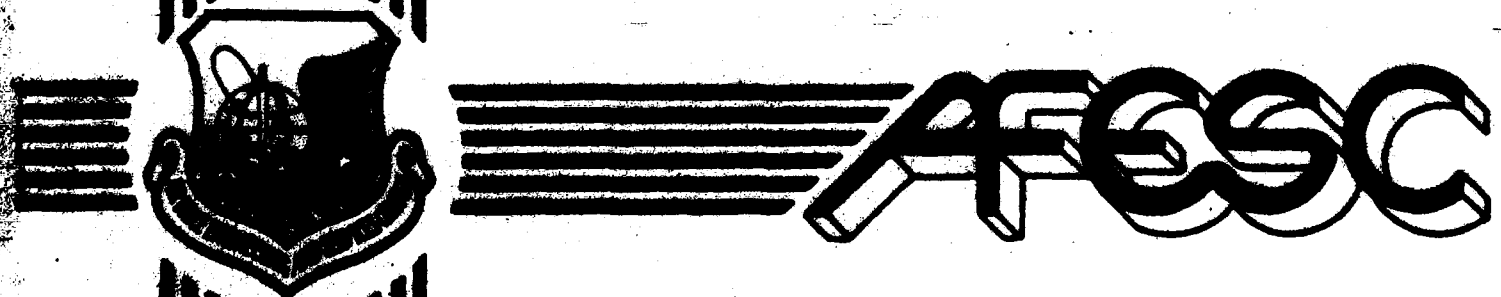
SEPTEMBER 1989

FINAL REPORT

OCTOBER 1987 — SEPTEMBER 1988

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MAY 1 1990
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6a. NAME OF PERFORMING ORGANIZATION EG&G Idaho, Inc			6b. OFFICE SYMBOL (if applicable) Chem Science		7a. NAME OF MONITORING ORGANIZATION Air Force Engineering and Services Center
6c. ADDRESS (City, State, and ZIP Code) P.O. Box 1625 Idaho Falls ID 83415			7b. ADDRESS (City, State, and ZIP Code) HQ AFESC/RDVS Tyndall AFB FL 32403-6001		
8a. NAME OF FUNDING / SPONSORING ORGANIZATION		8b. OFFICE SYMBOL (if applicable)		9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER Contract # DE-AC07-76ID01570	
8c. ADDRESS (City, State, and ZIP Code)			10. SOURCE OF FUNDING NUMBERS		
			PROGRAM ELEMENT NO. 63723F	PROJECT NO. 2054	TASK NO. 71
			WORK UNIT ACCESSION NO. 04		
11. TITLE (Include Security Classification) Substitution of Wax and Grease Cleaners with Biodegradable Solvents, Phase I Report (UNCLASSIFIED) PART III					
12. PERSONAL AUTHOR(S) P.M. Wikoff, R.K. Schober, T.L. Harris, D.F. Suci, R.E. McAtee, G.S. Carpenter, P.A. Pryfogle, J.M. Beller,					
13a. TYPE OF REPORT Final		13b. TIME COVERED FROM 10/87 TO 9/88		14. DATE OF REPORT (Year, Month, Day) September 1989	
				15. PAGE COUNT 524	
16. SUPPLEMENTARY NOTATION Availability of this report is specified on reverse of front cover.					
17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)		
FIELD	GROUP	SUB-GROUP	solvents, cleaners, halogenated, hydrocarbon, biodegradable, industrial wastewater, hazardous waste minimization, Test Data, Waxes, Greases. (JG)		
7	02				
19. ABSTRACT (Continue on reverse if necessary and identify by block number) Methods have been tested for systematic evaluations of biodegradable solvents for aircraft parts cleaning, degreasing, and masking-wax removal processes. Screening tests have identified solvents that are biodegradable, can efficiently remove soils from aircraft parts in a dip tank, and meet the military specification requirement for corrosiveness (ANSI/ASTM) in processes used at the five Air Force Air Logistics Centers (ALCs). The database developed during Phase I, of this program identifies each process, the chemicals used, tank volumes, testing requirements, and alternative chemicals. To test solvent biodegradability, an ASTM method was modified and used to test a bench-scale activated sludge system by measuring chemical oxygen demand (COD) and adenosine triphosphate (ATP) over a 6-hour period to determine if the bacteria will reduce COD to below the limit established by the National Pollution Discharge Elimination System (NPDES). Solvents were categorized to identify any trends, and six were selected for in-depth pilot-scale testing.					
20. DISTRIBUTION / AVAILABILITY OF ABSTRACT <input checked="" type="checkbox"/> UNCLASSIFIED/UNLIMITED <input type="checkbox"/> SAME AS RPT. <input type="checkbox"/> DTIC USERS			21. ABSTRACT SECURITY CLASSIFICATION UNCLASSIFIED		
22a. NAME OF RESPONSIBLE INDIVIDUAL Mr. Charles J. Carpenter			22b. TELEPHONE (Include Area Code) 904 2832942		22c. OFFICE SYMBOL HQ AFESC/RDVS


PREFACE

This report was prepared by Idaho National Engineering Laboratory, EG&G Idaho, Inc., P.O. Box 1625 Idaho Falls, Idaho 83415 under Contract Number DE-AC07-76ID01570 for the Air Force Engineering and Services Center (AFESC), Tyndall Air Force Base, Florida 32403-6001. Mr Charles J. Carpenter was the Government technical program manager. This report summarizes work accomplished between 1 October 1987 and 30 March 1989.

This report has been reviewed by the Public Affairs Office and is releasable to the National Technical Information Service (NTIS). At NTIS it will be available to the general public, including foreign nations.

This technical publication has been reviewed and is approved for publication.


CHARLES J. CARPENTER
Project Officer


KENNETH T. DENBLEYKER, Maj, USAF
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Branch


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Chief, Environics Division


JAMES R. VAN ORMAN
Deputy Director
Engineering and Services Laboratory

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DTIC TAB	<input type="checkbox"/>
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Justification	
By	
Distribution/	
Availability Codes	
Dist	Avail and/or Special
A-1	

APPENDIX G

TEST DATA

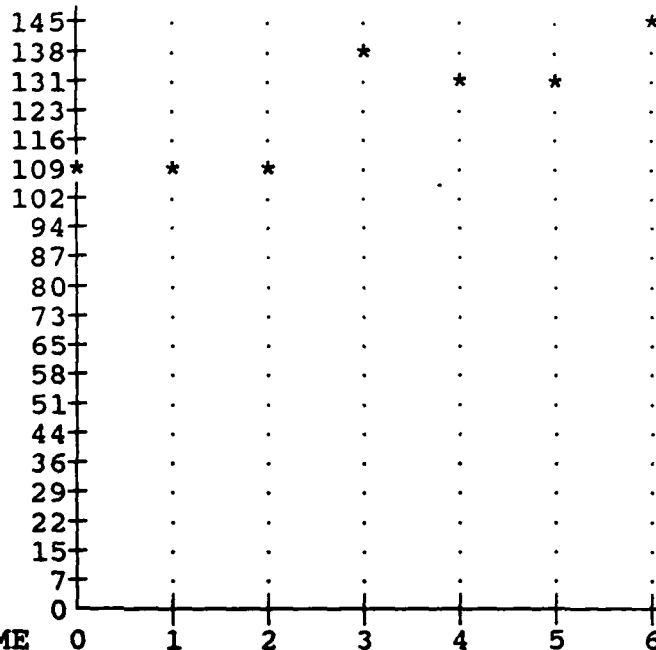
These figures and tables contain the test data for the biodegradability, solubility, and cleaning efficiency tests. For each set of solvents the first tables contain the biodegradability tests, a plot of COD versus time, along with the change in ATP during the test. The plot directly below is the plot of the control phenol that was run during the same day. Also on that plot are the solvents that were run on the same day. Also listed are TOC before testing, COD before testing, and TOC after testing.

Following the biodegradability plots are the plots for cleaning efficiency. The solvent is listed, the conditions at which it was tested, the alloy used, and the results in table and plot form.

COMPANY - 3 D INC.
 PRODUCT - 3D SUPREME
 TOC INIT- 52475
 TOC 2nd - 0
 COD INIT- 148000
 ANILINE PT - 0.0000
 ATP ----- 1 E-8

SOLUBILITY DATA:

1-3 @ 180 1%



0- 112
 1- 109
 2- 108
 3- 138
 4- 134
 5- 132
 6- 145

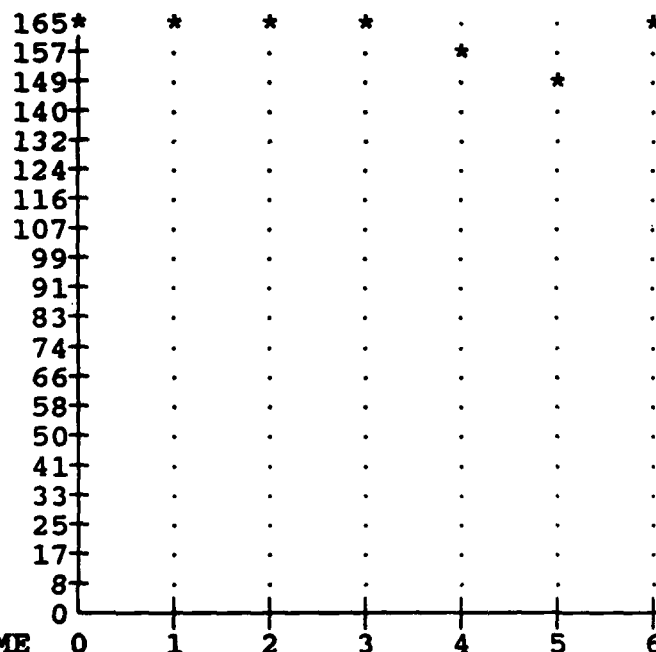
DRY
 WEIGHT
 0.0597

DATE - 02/25/88

COD vs TIME

PHENOL
 02/25/88
 ATP - 16 E-8

3 D INC.
 3D SUPREME



0- 165
 1- 165
 2- 165
 3- 165
 4- 154
 5- 146
 6- 165

DRY
 WEIGHT
 0.0597

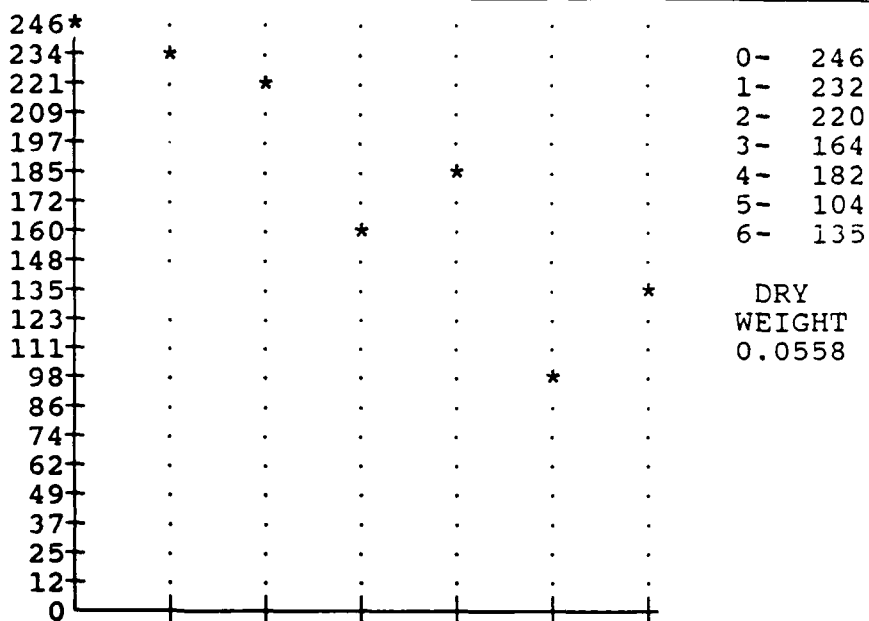
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COD vs TIME

COMPANY - 3 D INC.
 PRODUCT - 3D SUPREME
 TOC INIT- 52475
 TOC 2nd - 0
 COD INIT- 148000
 ANILINE PT - 0.0000
 ATP ----- 93 E-8

SOLUBILITY DATA:

1-3 @ 180 1%



0- 246
 1- 232
 2- 220
 3- 164
 4- 182
 5- 104
 6- 135

DRY
 WEIGHT
 0.0558

DATE - 03/07/88

COD vs TIME

PHENOL
 03/07/88
 ATP - 211 E-8

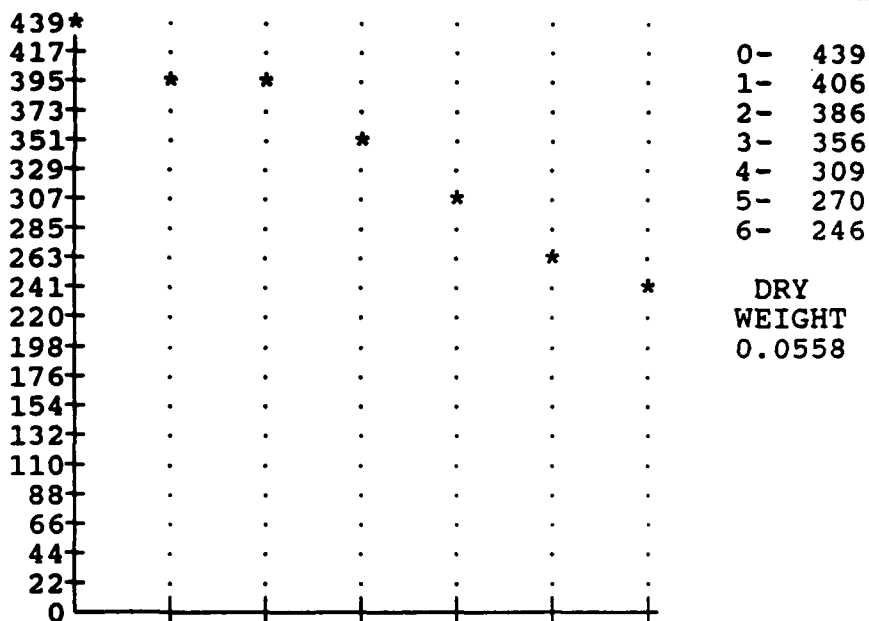
3 D INC.
 3D SUPREME

3 D INC.
 CITRIGOLD

3 D INC.
 SIEGE

BARTLETT CHEMICAL INC.
 DOLPHIN 281

BIO-TEK INC.
 134 HI-SOLV



0- 439
 1- 406
 2- 386
 3- 356
 4- 309
 5- 270
 6- 246

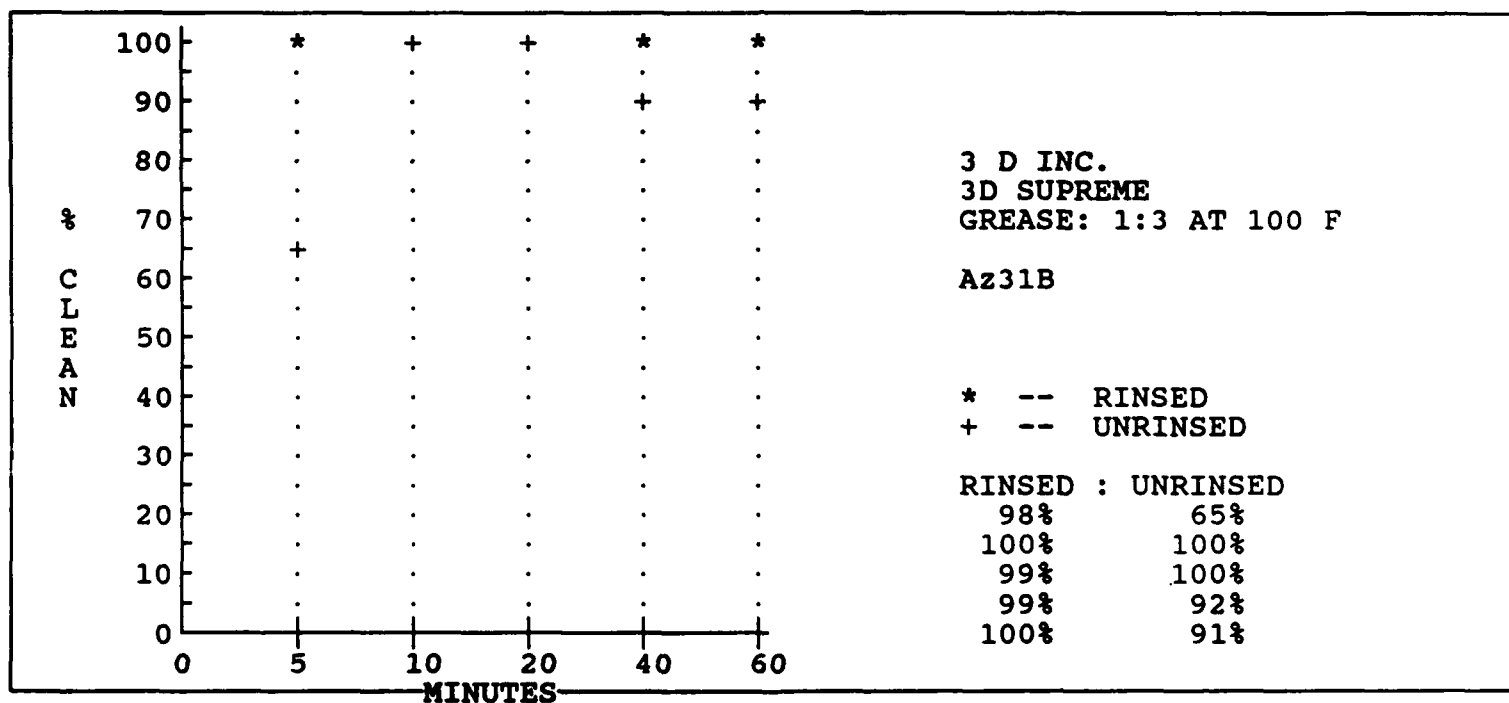
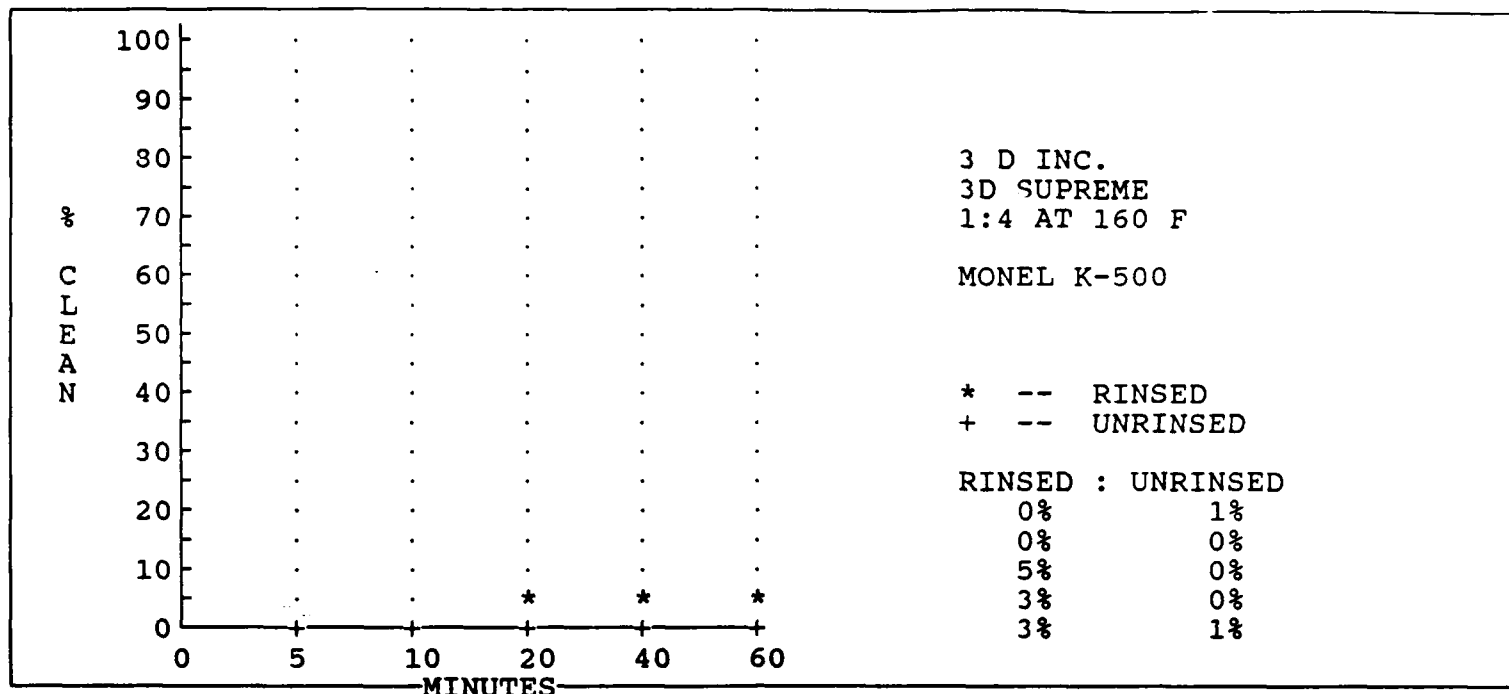
DRY
 WEIGHT
 0.0558

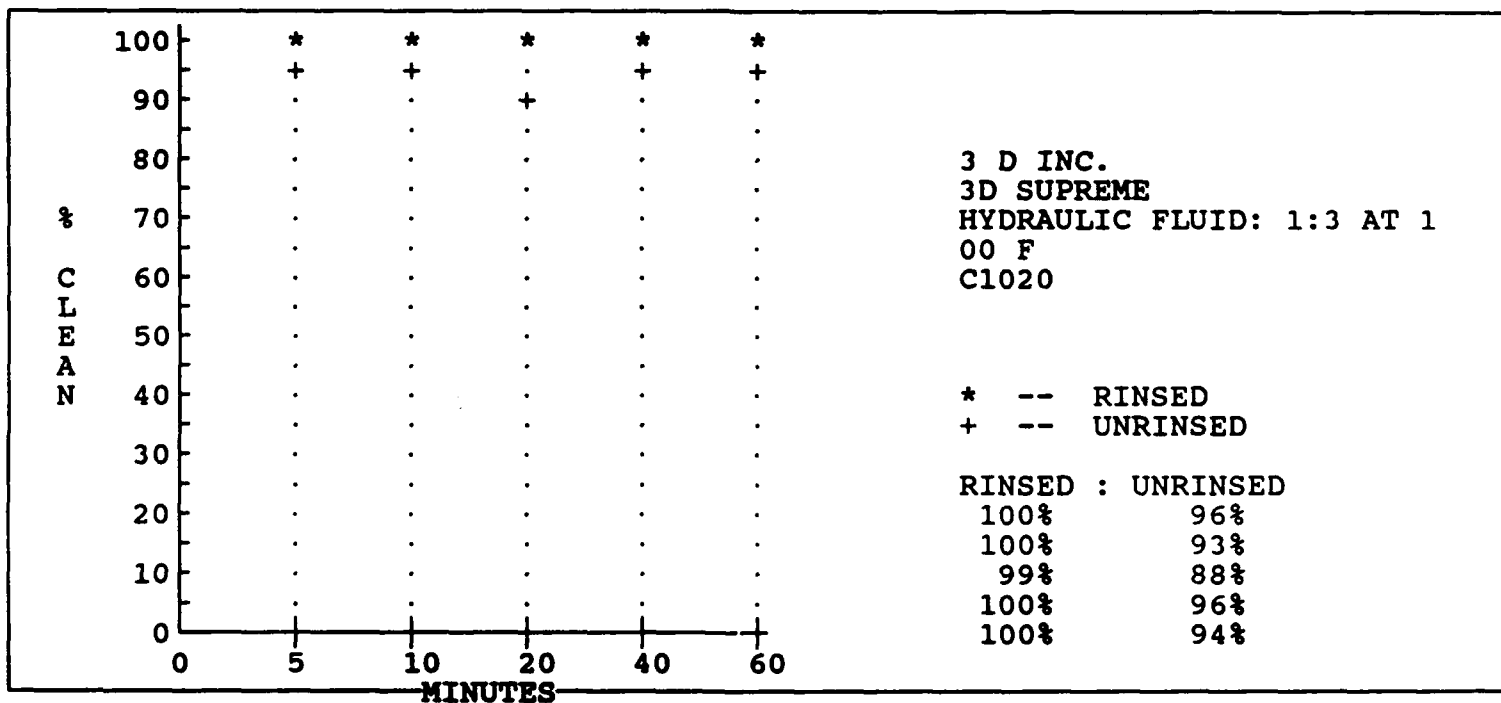
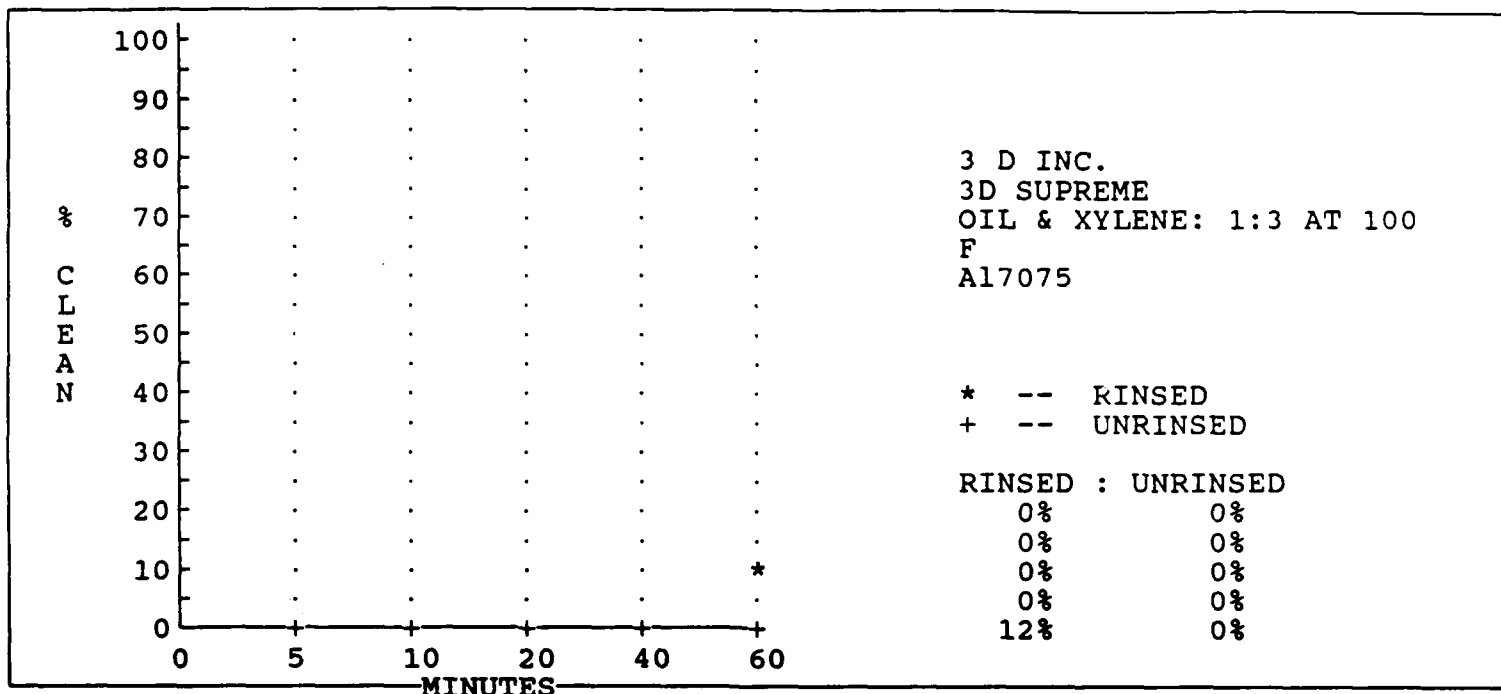
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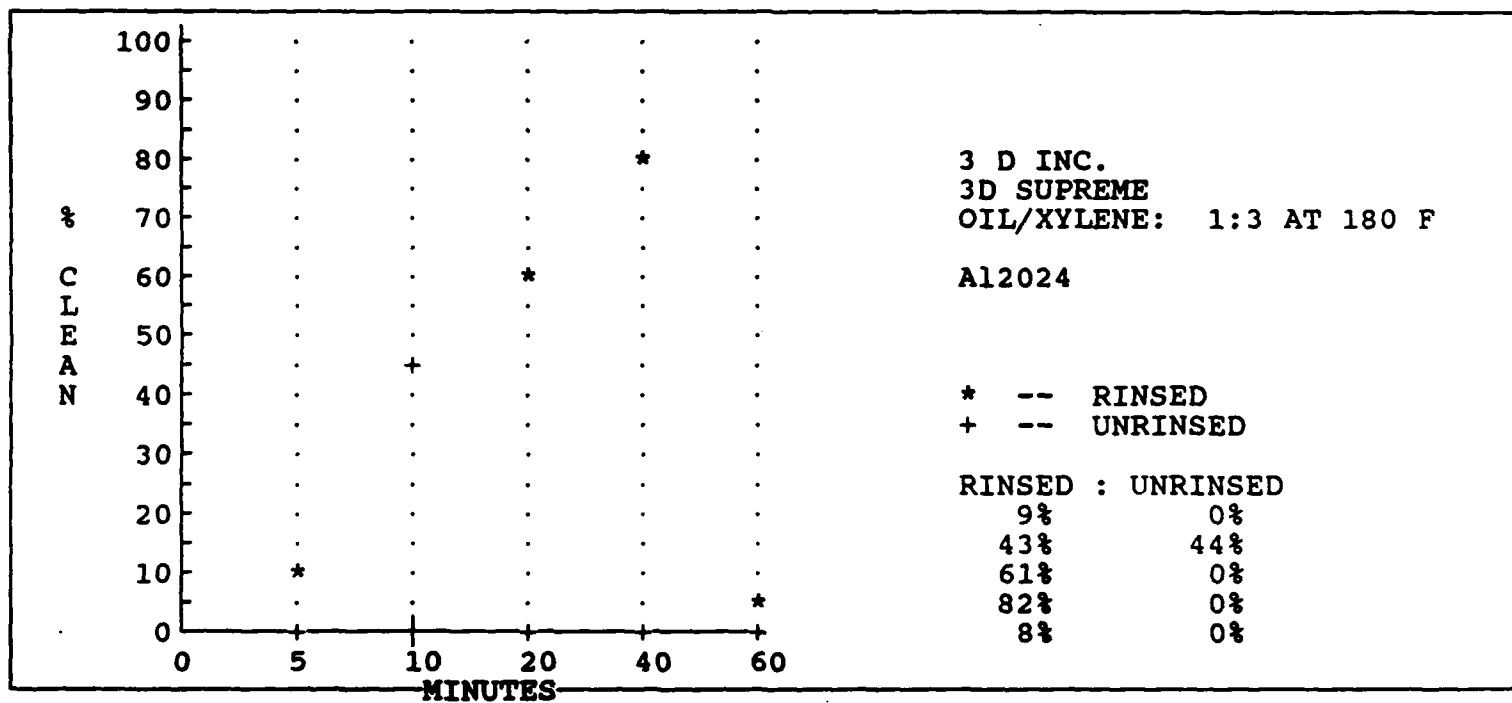
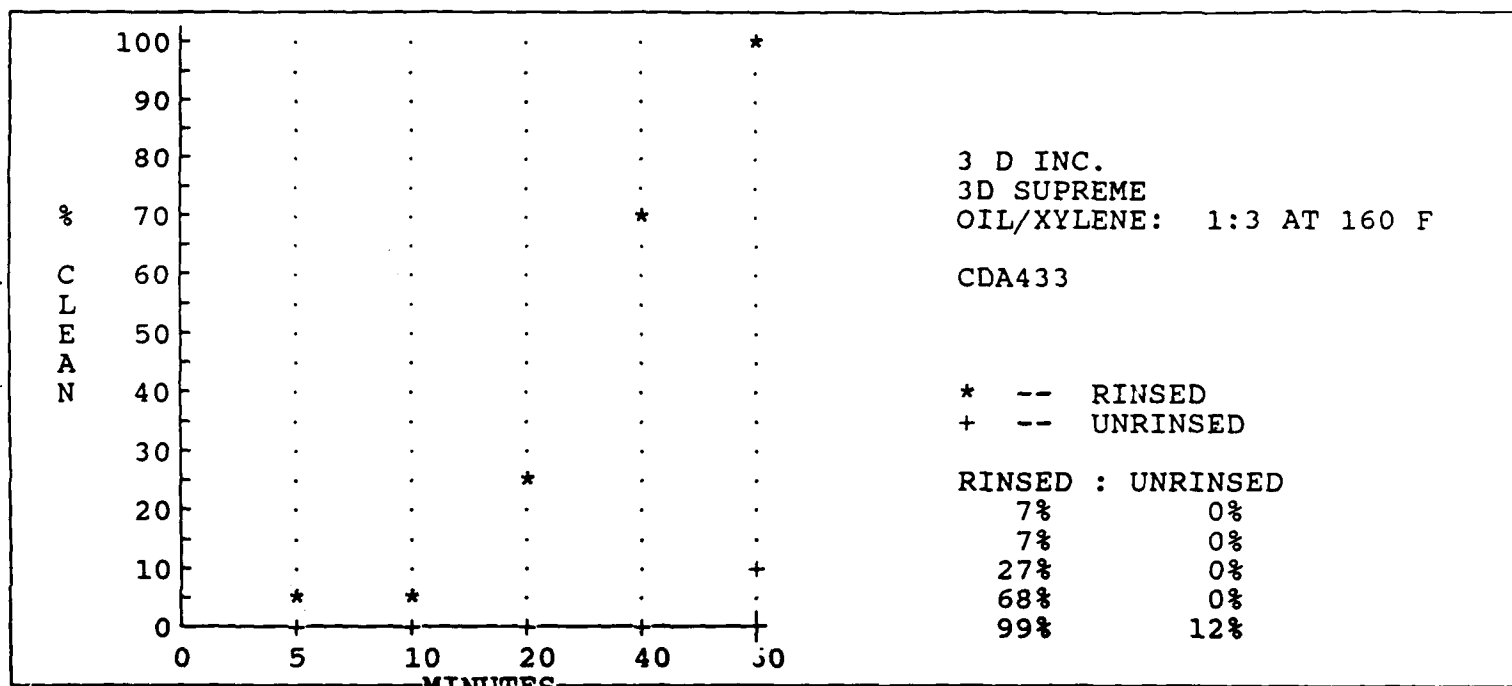
COD vs TIME

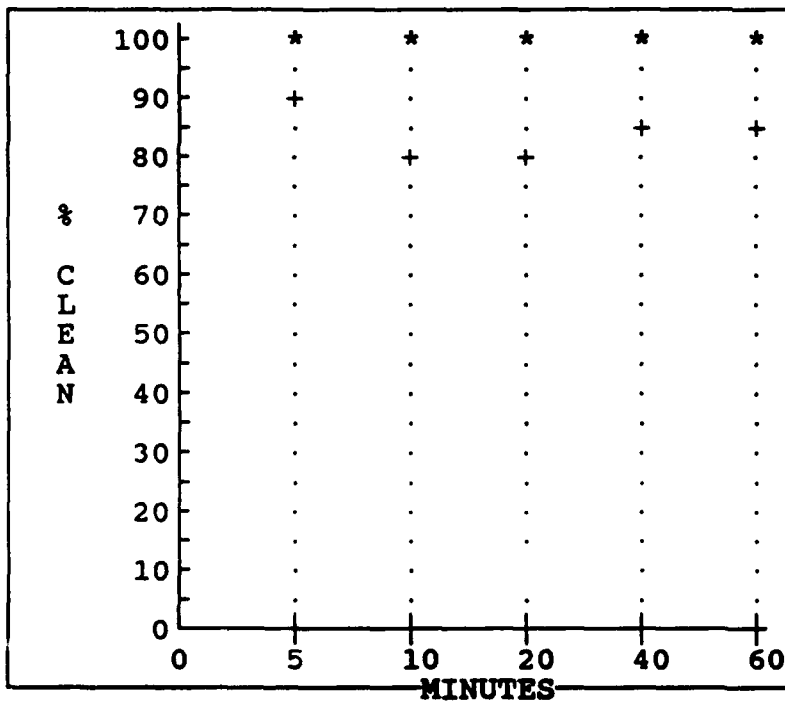
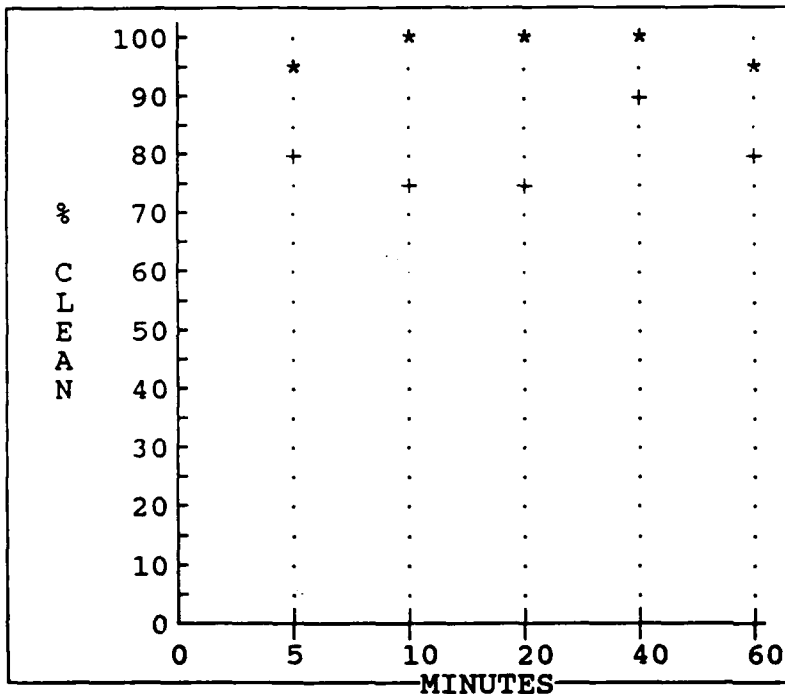
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PRODUCT - 3D SUPREME	172	.	.	*	.	*	.	0- 140
TOC INIT- 52475	163	*	1- 160
TOC 2nd - 0	154	*	2- 181
COD INIT- 148000	145	3- 170
ANILINE PT - 0.0000	136*	.	.	.	.	.	.	4- 180
ATP ----- -21 E-8	127	.	.	.	.	.	.	5- 176
	118	.	.	.	.	.	.	6- 150
SOLUBILITY DATA:	109	.	.	.	.	.	.
1-3 @ 180 1%	100	.	.	.	.	.	.	DRY
	91	.	.	.	.	.	.	WEIGHT
	81	.	.	.	.	.	.	0.0600
	72	.	.	.	.	.	.
	63	.	.	.	.	.	.
	54	.	.	.	.	.	.
	45	.	.	.	.	.	.
	36	.	.	.	.	.	.
	27	.	.	.	.	.	.
	18	.	.	.	.	.	.
	9	.	.	.	.	.	.
	0	.	.	.	.	.	.
DATE - 03/22/88 COD vs TIME	0	1	2	3	4	5	6	

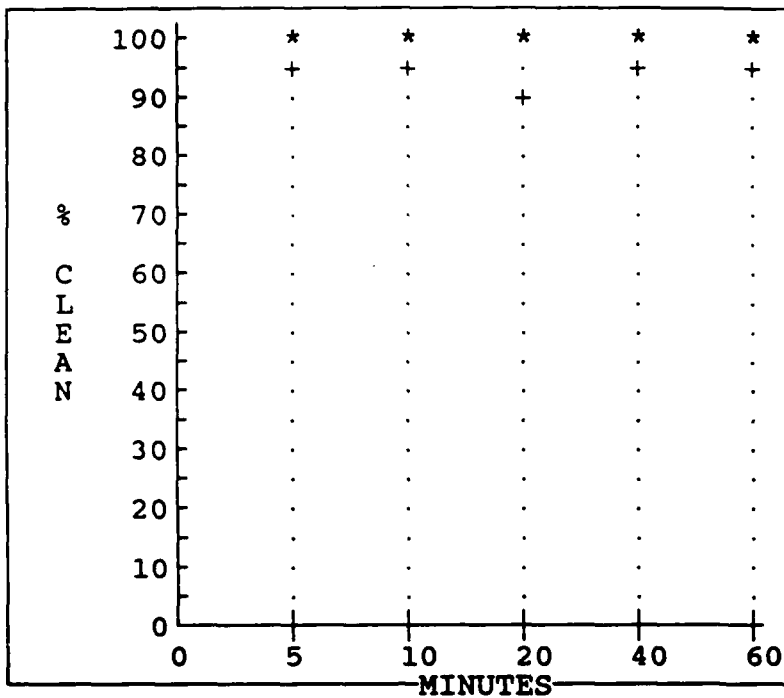
PHENOL	306*	.	.	.	.	.	.	0- 306
03/22/88	291	.	.	.	.	.	.	1- 178
ATP - 69 E-8	275	.	.	.	.	.	.	2- 58
	260	.	.	.	.	.	.	3- 36
	245	.	.	.	.	.	.	4- 37
	230	.	.	.	.	.	.	5- 34
3 D INC.	214	.	.	.	.	.	.	6- 12
3D SUPREME	199	.	.	.	.	.	.
	184	*	.	.	.	.	.	DRY
3 D INC.	168	.	.	.	.	.	.	WEIGHT
CITRIGOLD	153	.	.	.	.	.	.	0.0600
	138	.	.	.	.	.	.
ZEP MANUFACTURING CO.	122	.	.	.	.	.	.
BIG ORANGE	107	.	.	.	.	.	.
	92	.	.	.	.	.	.
ZEP MANUFACTURING CO.	77	.	.	.	.	.	.
ZEP 940	61	.	*	.	.	.	.
	46	.	.	.	.	.	.
ZEP MANUFACTURING CO.	31	.	.	*	*	*	.	
ZEPRIDE	15	.	.	.	.	.	*
	0	.	.	.	.	.	.
DATE - 03/22/88 COD vs TIME	0	1	2	3	4	5	6	







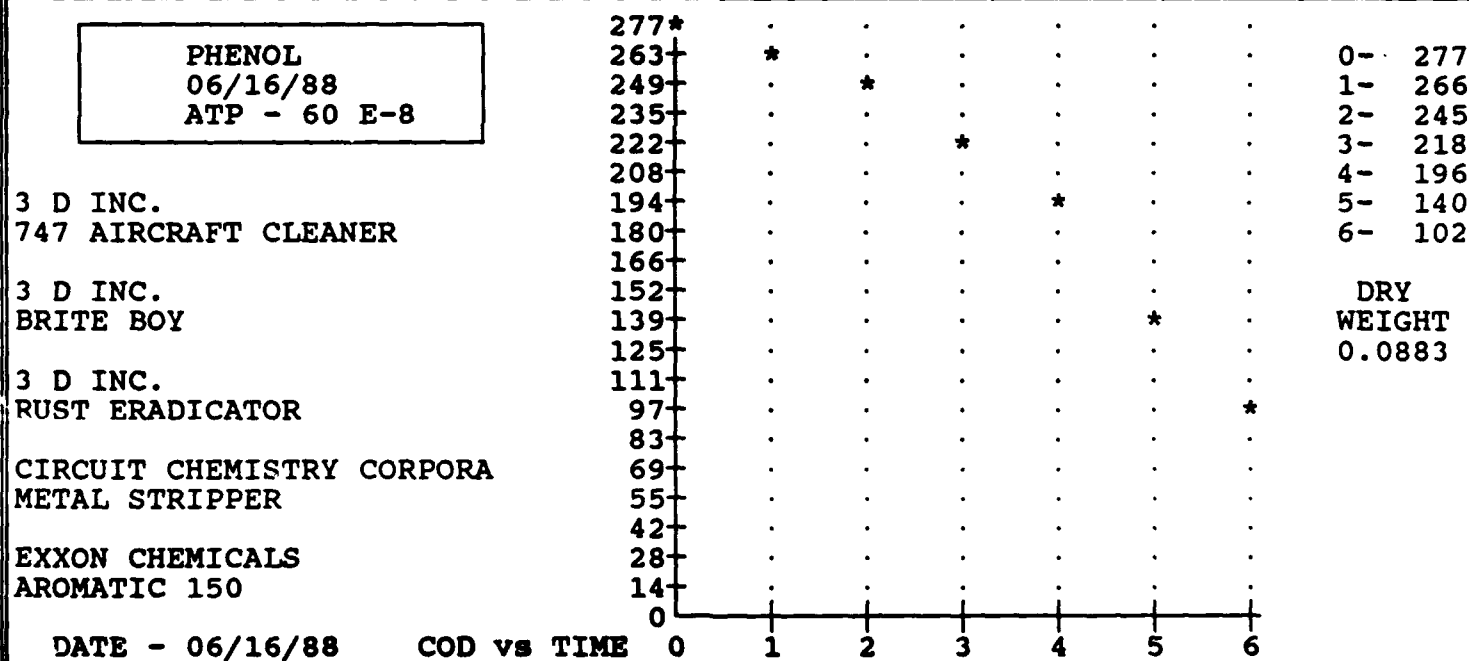
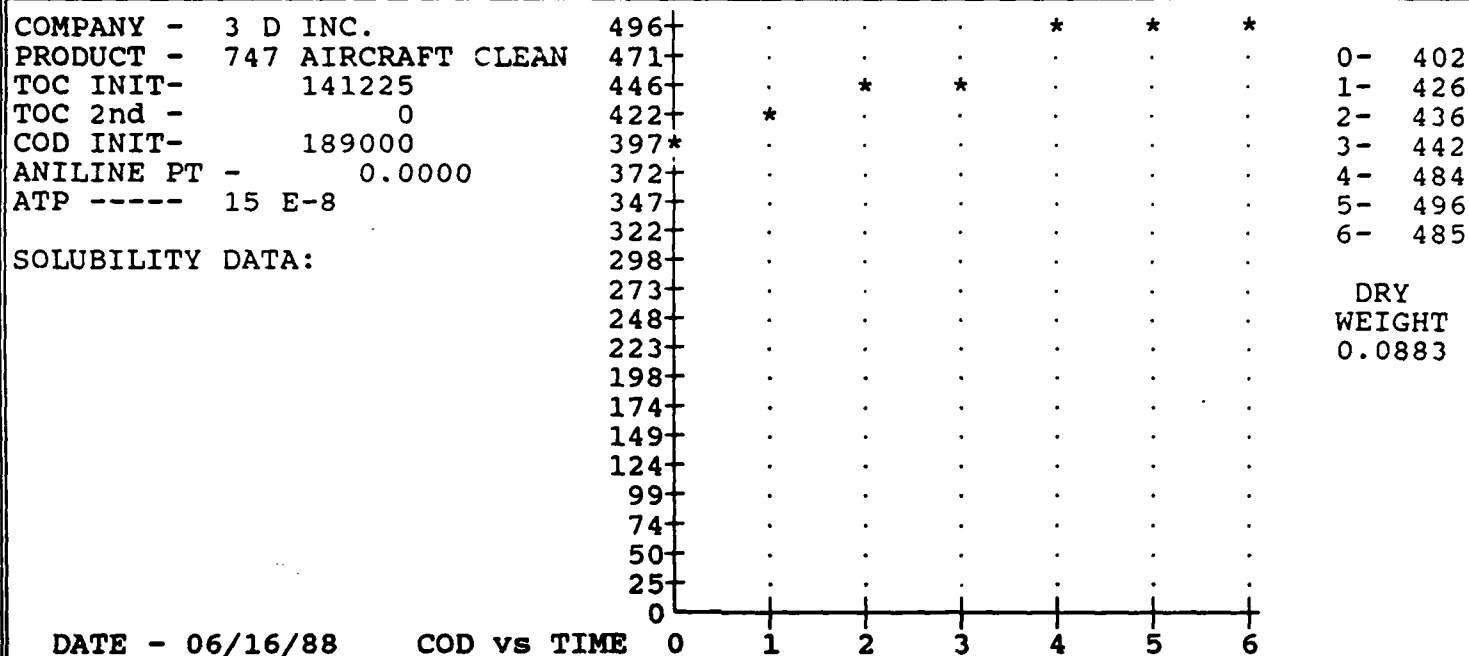


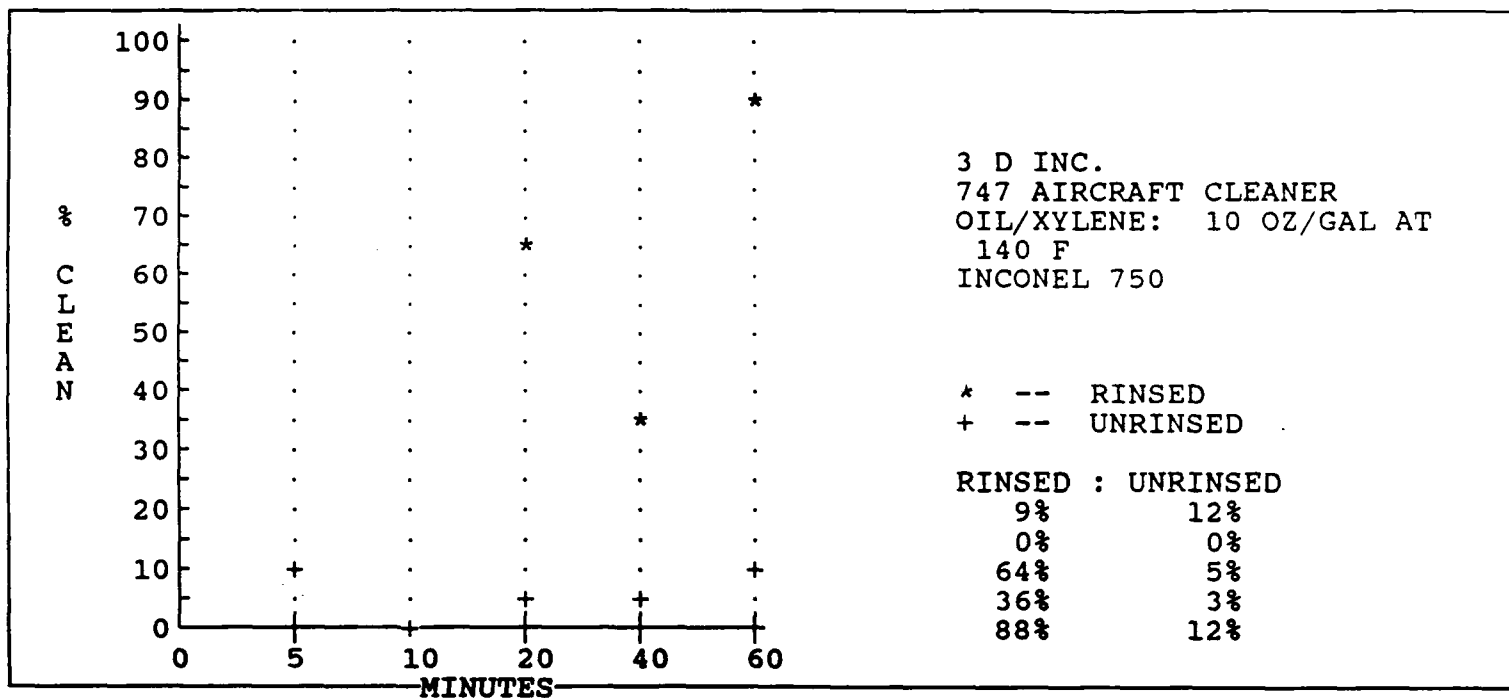


3 D INC.
 3D SUPREME
 HYDRAULIC FLUID: 1:3 AT
 100 F
 A12024

* -- RINSED
 + -- UNRINSED

RINSED :	UNRINSED
100%	96%
100%	93%
99%	88%
100%	96%
100%	94%





COMPANY - 3 D INC.	493	.	.	.	.	*	.
PRODUCT - BRITE BOY	468	.	.	.	.	.	*	0- 382
TOC INIT- 47954	444	.	.	.	*	.	.	1- 428
TOC 2nd - 0	419	*	*	*	.	.	.	2- 430
COD INIT- 548000	394	.	.	.	.	.	.	3- 428
ANILINE PT - 0.0000	370*	.	.	.	.	.	.	4- 456
ATP ----- -3 E-8	345	.	.	.	.	.	.	5- 493
	320	.	.	.	.	.	.	6- 480
SOLUBILITY DATA:	296	.	.	.	.	.	.
	271	.	.	.	.	.	.	DRY
	247	WEIGHT
	222	0.0883
	197	
	173	
	148	
	123	
	99	
	74	
	49	
	25	
	0	

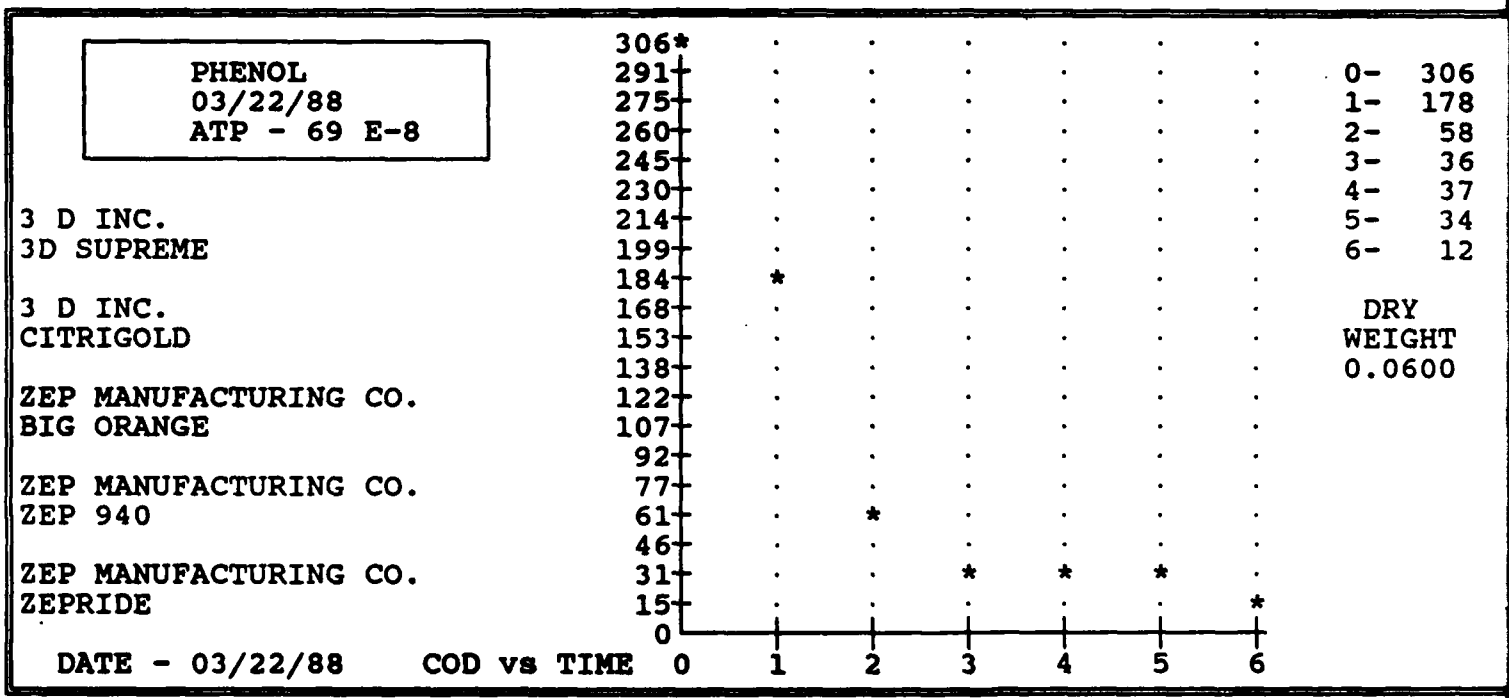
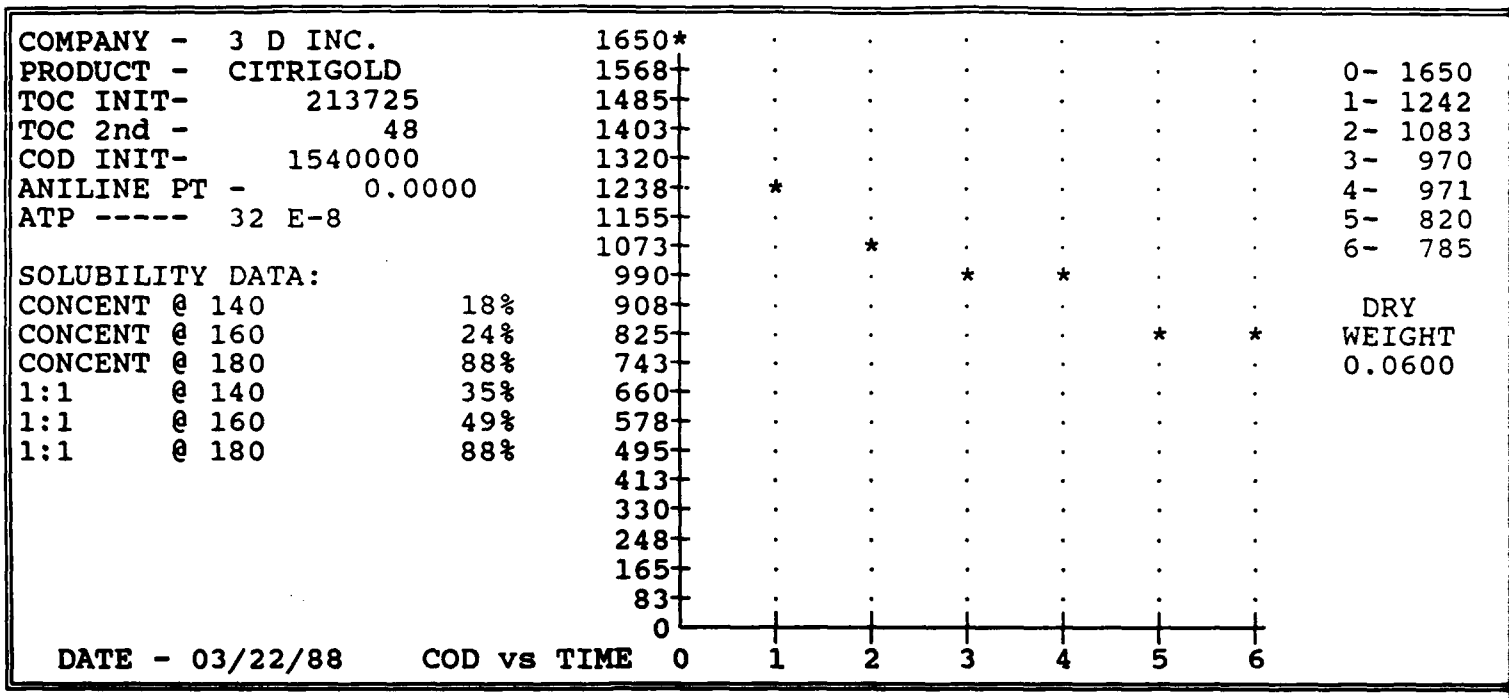
DATE - 06/16/88 COD vs TIME 0 1 2 3 4 5 6

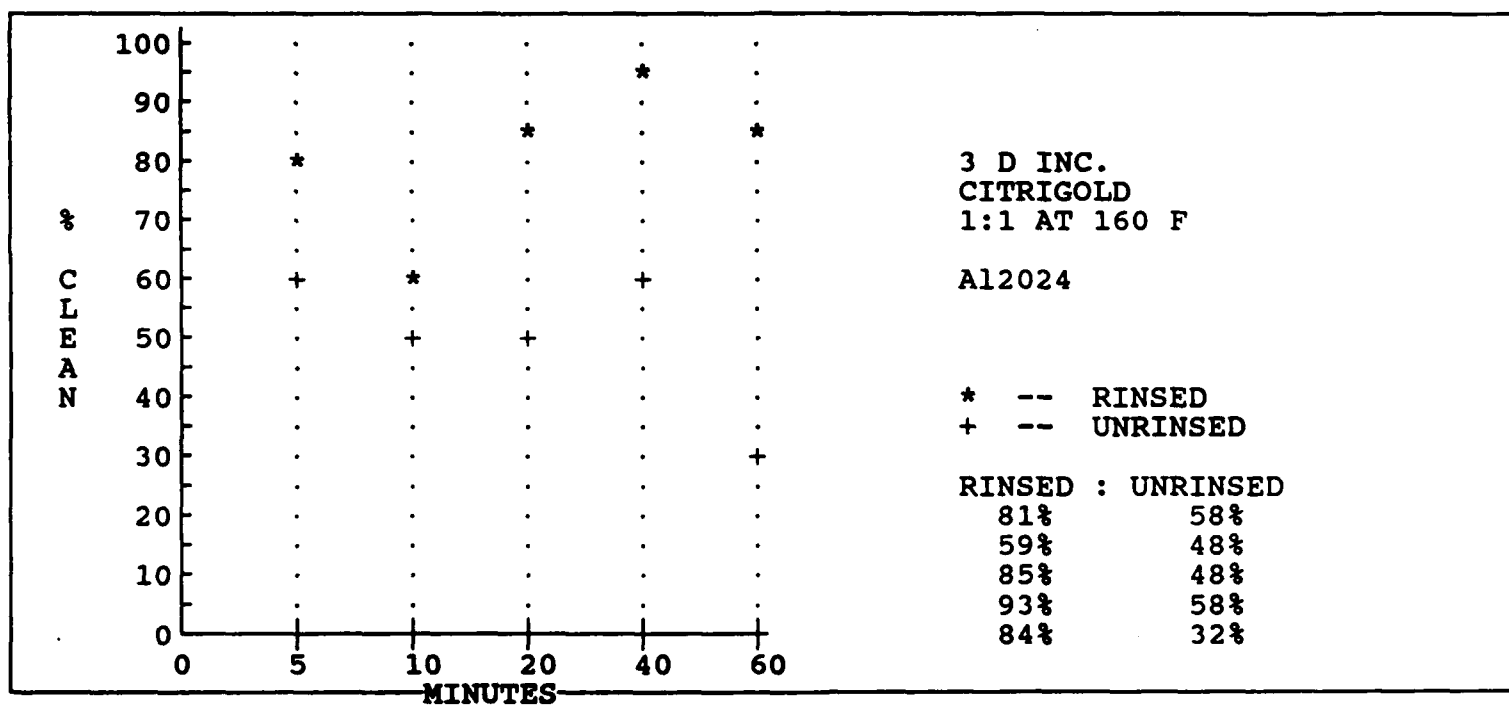
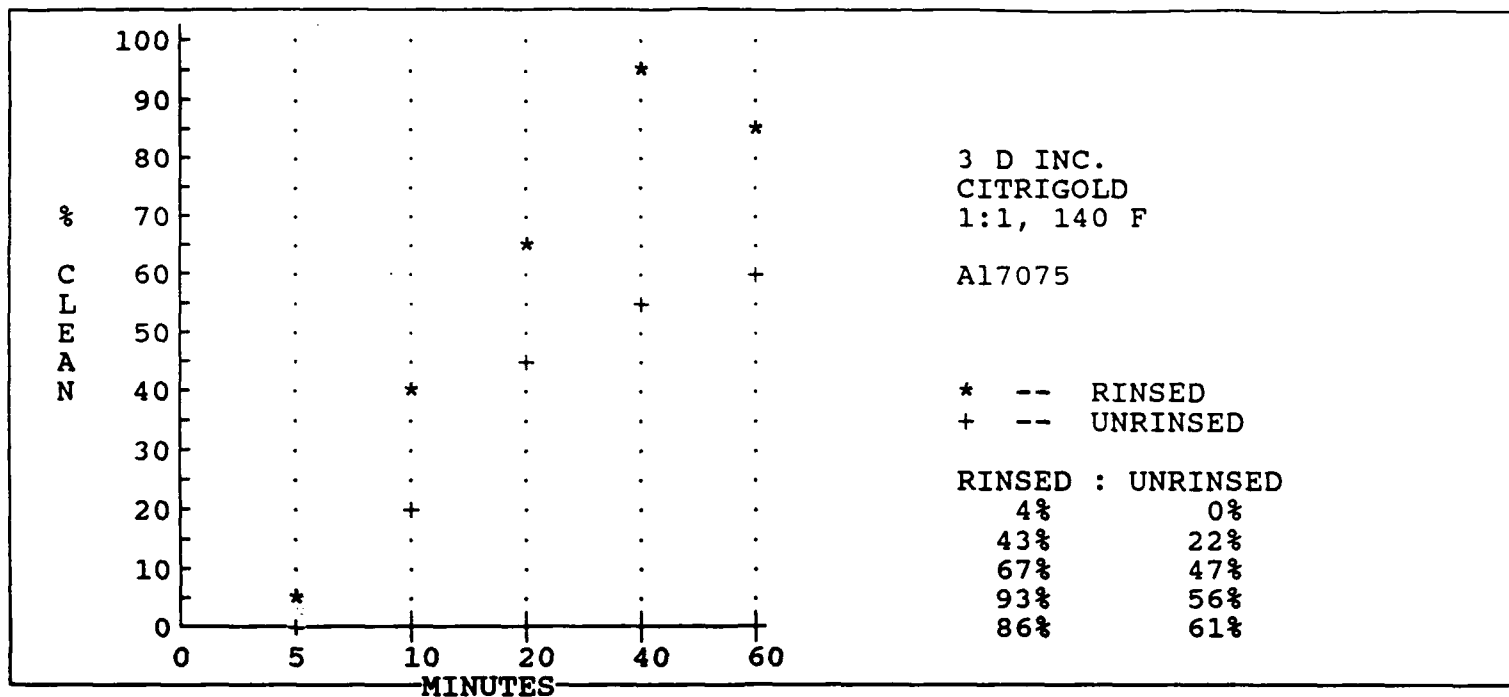
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	263	*	0- 277
	249	.	*	1- 266
	235	2- 245
	222	.	.	*	.	.	.	3- 218
	208	4- 196
3 D INC.	194	.	.	.	*	.	.	5- 140
747 AIRCRAFT CLEANER	180	6- 102
	166	.	.	.	.	.	.
3 D INC.	152	.	.	.	.	.	.	DRY
BRITE BOY	139	.	.	.	.	*	.	WEIGHT
	125	.	.	.	.	.	.	0.0883
3 D INC.	111	.	.	.	.	.	.
RUST ERADICATOR	97	.	.	.	.	.	*
	83	.	.	.	.	.	.
CIRCUIT CHEMISTRY CORPORA	69	.	.	.	.	.	.
METAL STRIPPER	55	.	.	.	.	.	.
	42	.	.	.	.	.	.
EXXON CHEMICALS	28	.	.	.	.	.	.
AROMATIC 150	14	.	.	.	.	.	.
	0	.	.	.	.	.	.

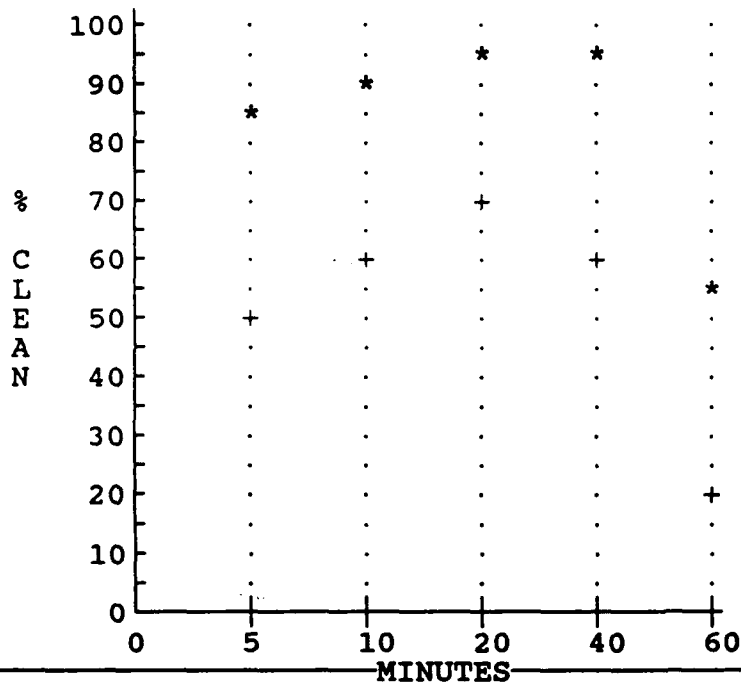
DATE - 06/16/88 COD vs TIME 0 1 2 3 4 5 6

COMPANY - 3 D INC.		1650*	*	.	.	.	.	.
PRODUCT - CITRIGOLD		1568	.	.	.	.	.	.	0- 1650
TOC INIT- 213725		1485	.	.	.	.	.	.	1- 1650
TOC 2nd - 48		1403	.	.	.	.	.	.	2- 1183
COD INIT- 1540000		1320	.	.	.	.	.	.	3- 1106
ANILINE PT - 0.0000		1238	.	.	.	.	.	.	4- 1091
ATP ----- 266 E-8		1155	.	*	.	.	.	.	5- 1040
		1073	.	.	*	*	*	.	6- 942
SOLUBILITY DATA:		990	.	.	.	.	.	.
CONCENT @ 140 18%		908	.	.	.	.	.	*	DRY
CONCENT @ 160 24%		825	.	.	.	.	.	.	WEIGHT
CONCENT @ 180 88%		743	.	.	.	.	.	.	0.0558
1:1 @ 140 35%		660	.	.	.	.	.	.
1:1 @ 160 49%		578	.	.	.	.	.	.
1:1 @ 180 88%		495	.	.	.	.	.	.
		413	.	.	.	.	.	.
		330	.	.	.	.	.	.
		248	.	.	.	.	.	.
		165	.	.	.	.	.	.
		83	.	.	.	.	.	.
		0	.	.	.	.	.	.
DATE - 03/07/88	COD vs TIME	0	1	2	3	4	5	6	

PHENOL		439*	.	.	.	.	.	.
03/07/88		417	.	.	.	.	.	.	0- 439
ATP - 211 E-8		395	*	*	.	.	.	.	1- 406
		373	.	.	.	.	.	.	2- 386
		351	.	.	*	.	.	.	3- 356
		329	.	.	.	.	.	.	4- 309
3 D INC.		307	.	.	.	*	.	.	5- 270
3D SUPREME		285	.	.	.	.	.	.	6- 246
		263	.	.	.	.	*	.
3 D INC.		241	.	.	.	.	.	*	DRY
CITRIGOLD		220	.	.	.	.	.	.	WEIGHT
		198	.	.	.	.	.	.	0.0558
3 D INC.		176	.	.	.	.	.	.
SIEGE		154	.	.	.	.	.	.
		132	.	.	.	.	.	.
BARTLETT CHEMICAL INC.		110	.	.	.	.	.	.
DOLPHIN 281		88	.	.	.	.	.	.
		66	.	.	.	.	.	.
BIO-TEK INC.		44	.	.	.	.	.	.
134 HI-SOLV		22	.	.	.	.	.	.
		0	.	.	.	.	.	.
DATE - 03/07/88	COD vs TIME	0	1	2	3	4	5	6	





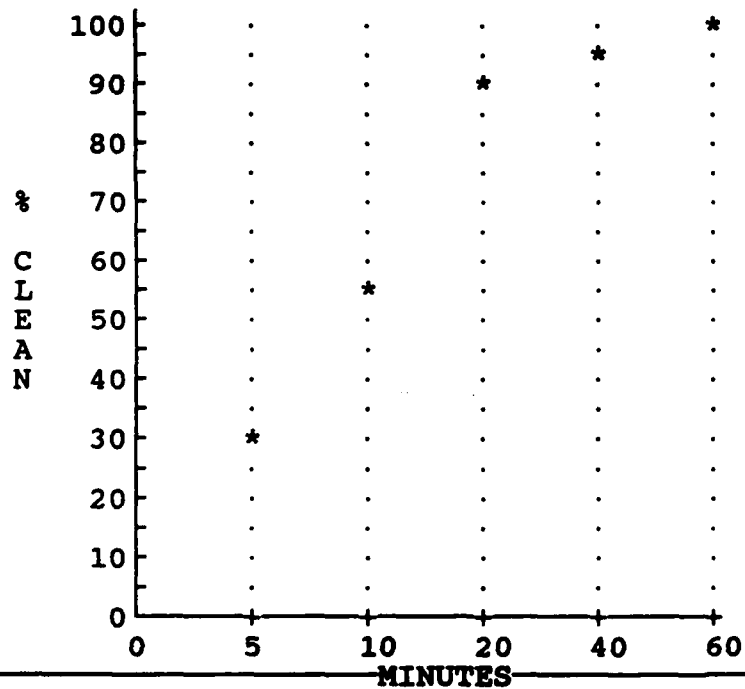


3 D INC.
CITRIGOLD
1:1 AT 180 F

A17075

* -- RINSED
+ -- UNRINSED

RINSED :	UNRINSED
87%	50%
88%	59%
96%	69%
94%	60%
53%	18%



3 D INC.
CITRIGOLD
CONCENTRATE @ 180

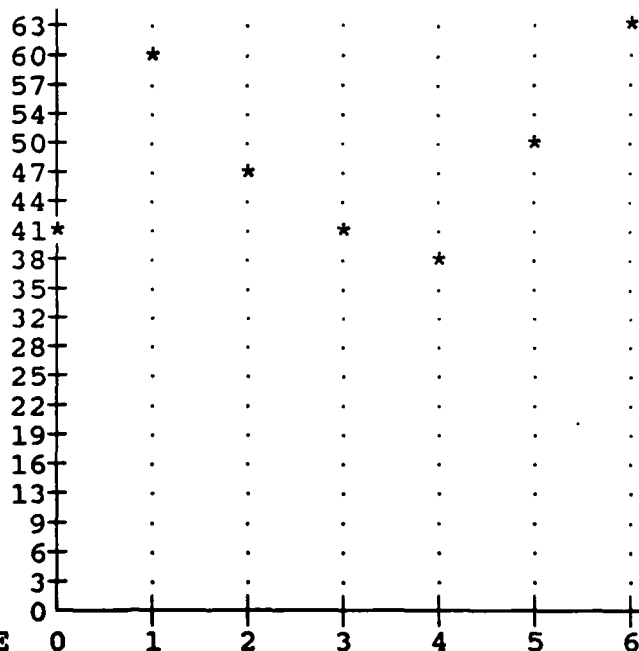
A17075

* -- RINSED
+ -- UNRINSED

RINSED :	UNRINSED
31%	0%
54%	0%
91%	0%
95%	0%
99%	0%

COMPANY - 3 D INC.
 PRODUCT - RUST ERADICATOR
 TOC INIT- 42236
 TOC 2nd - 0
 COD INIT- 675000
 ANILINE PT - 0.0000
 ATP ----- -15 E-8

SOLUBILITY DATA:



DRY
 WEIGHT
 0.0883

DATE - 06/16/88

COD vs TIME

0 1 2 3 4 5 6

PHENOL
 06/16/88
 ATP - 60 E-8

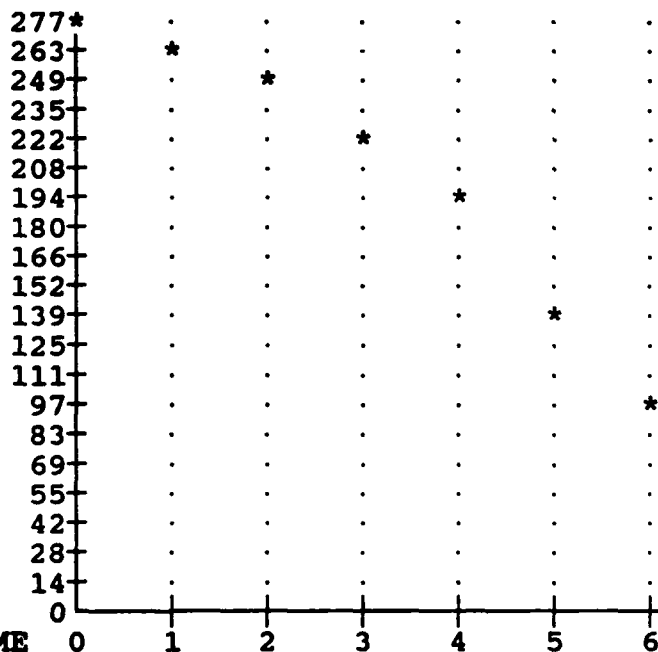
3 D INC.
 747 AIRCRAFT CLEANER

3 D INC.
 BRITE BOY

3 D INC.
 RUST ERADICATOR

CIRCUIT CHEMISTRY CORPORA
 METAL STRIPPER

EXXON CHEMICALS
 AROMATIC 150

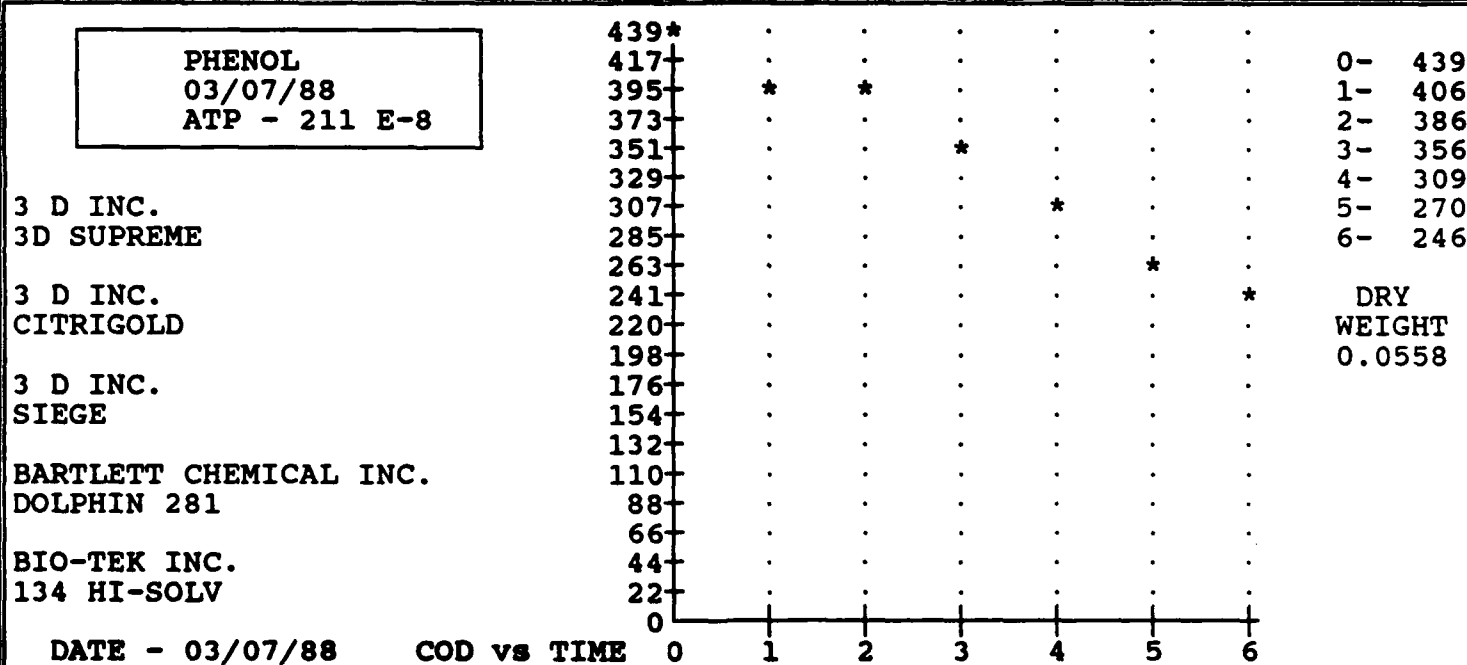
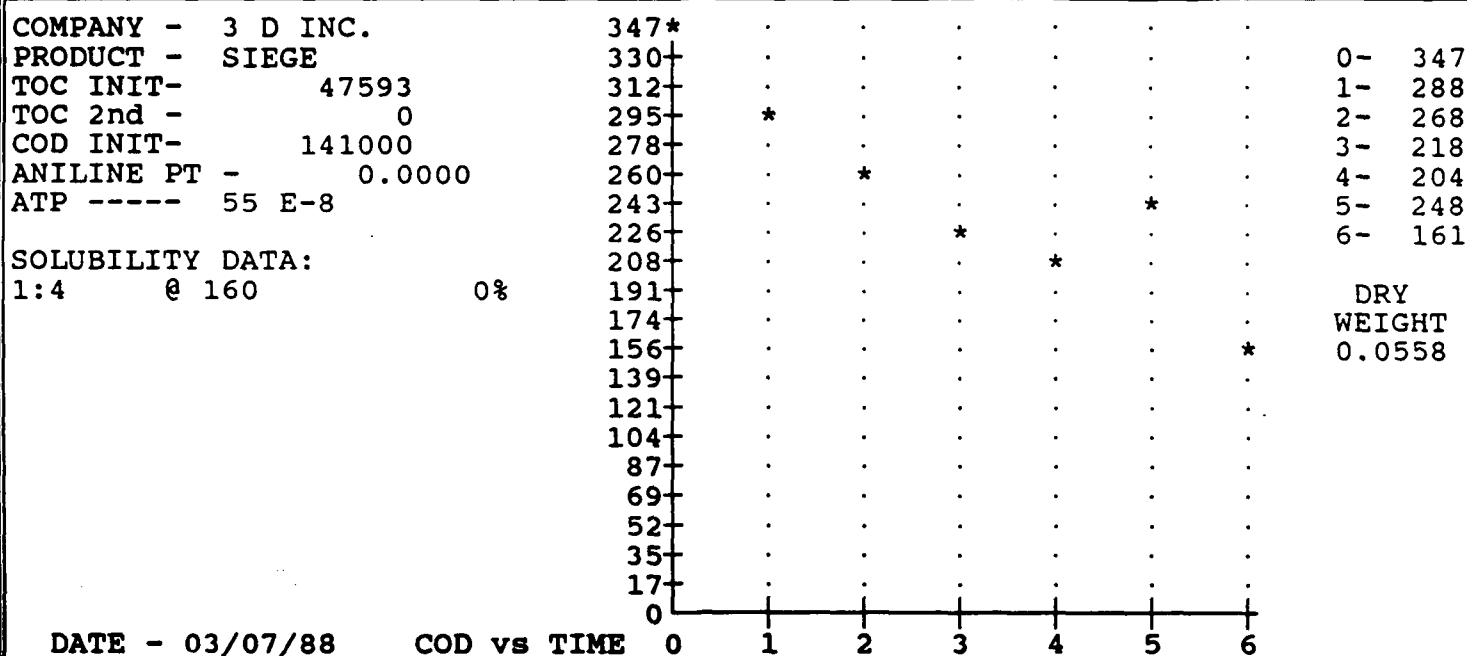


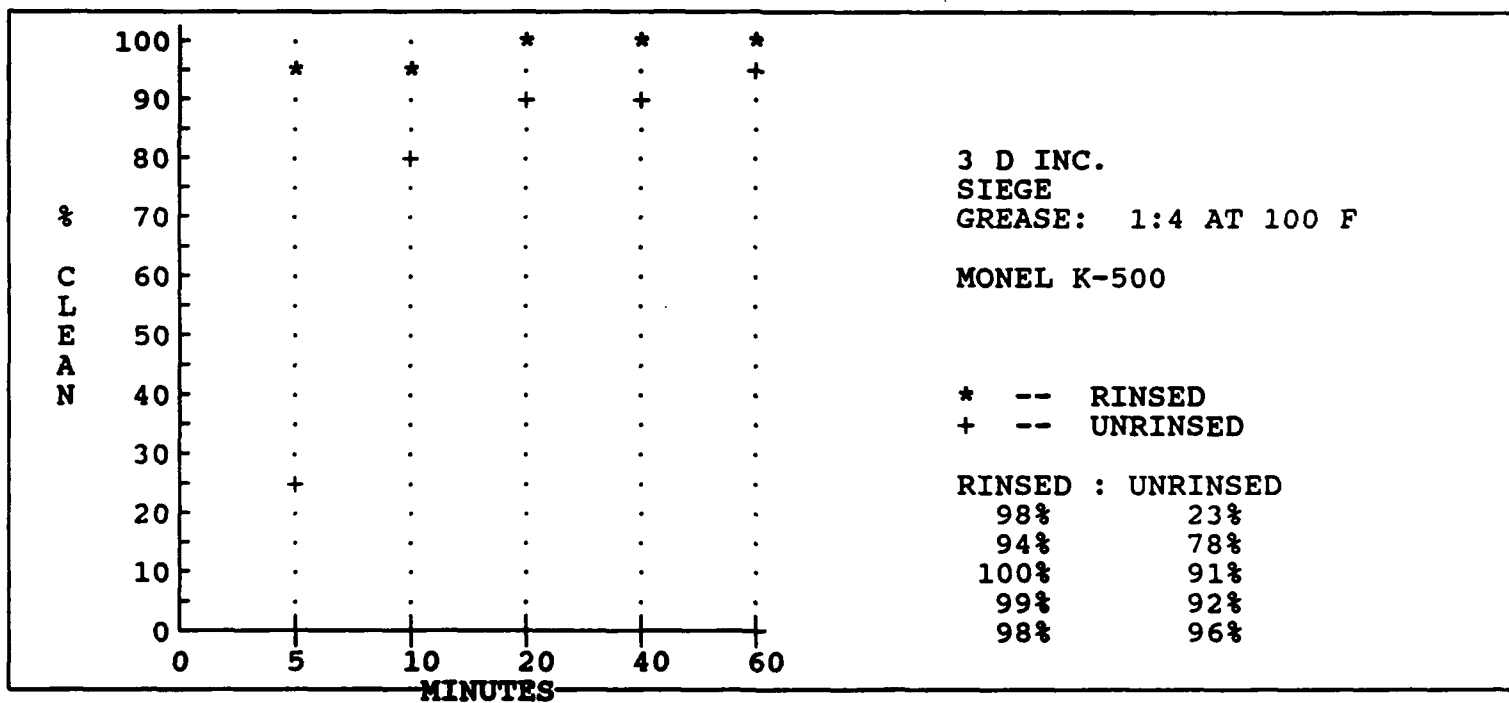
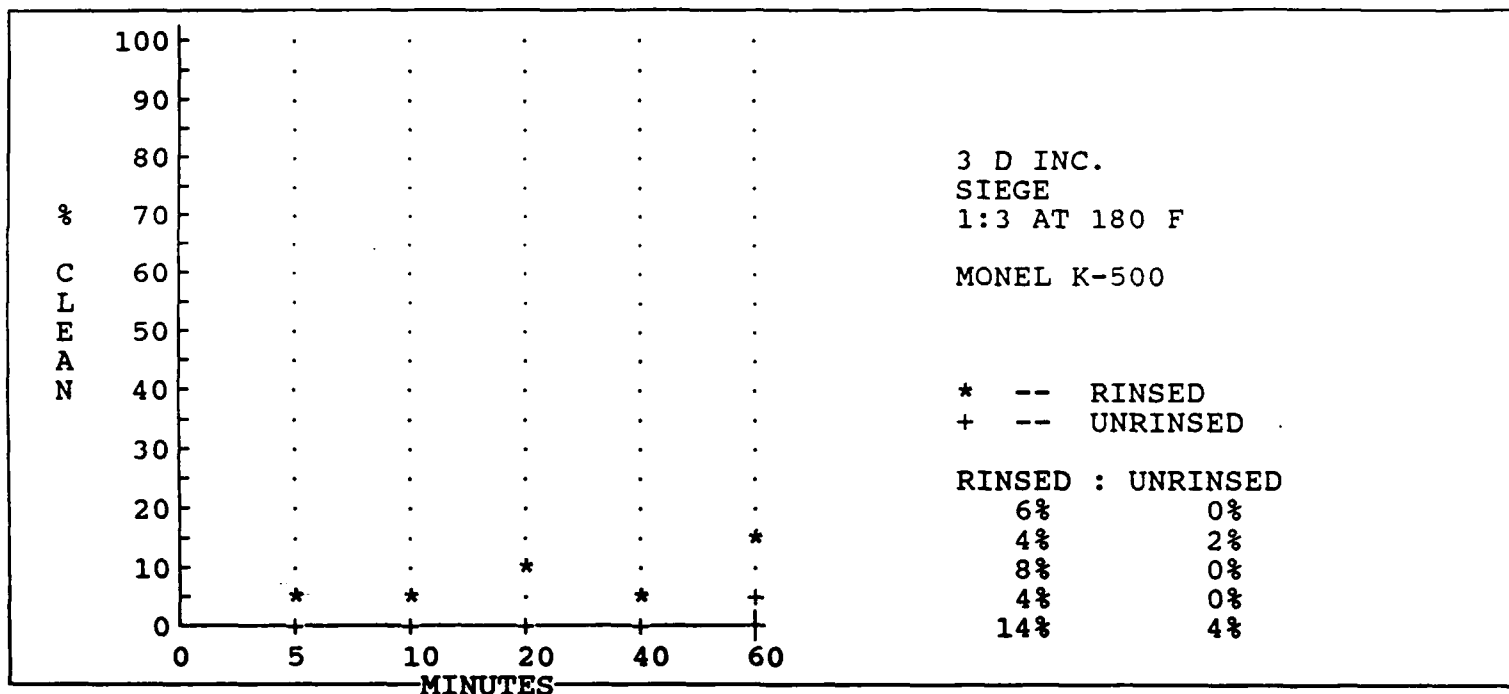
DRY
 WEIGHT
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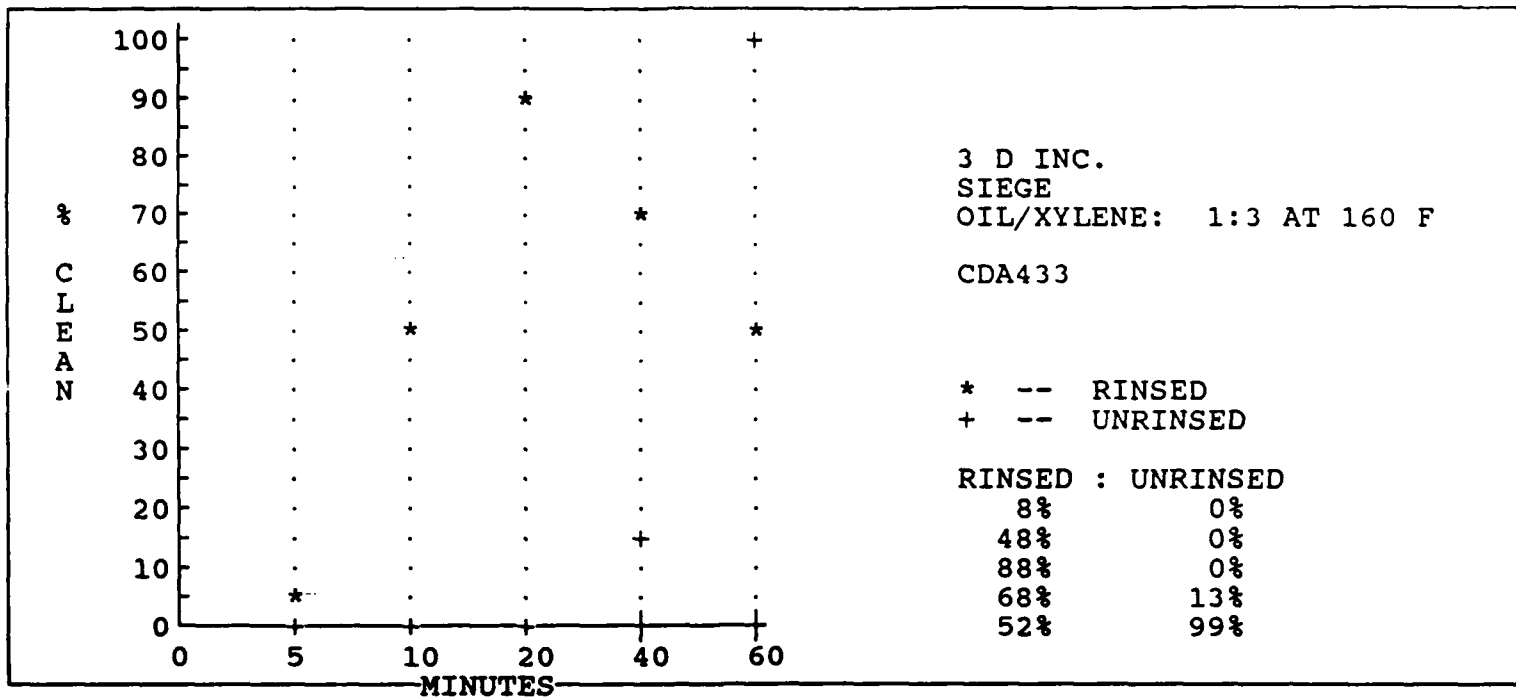
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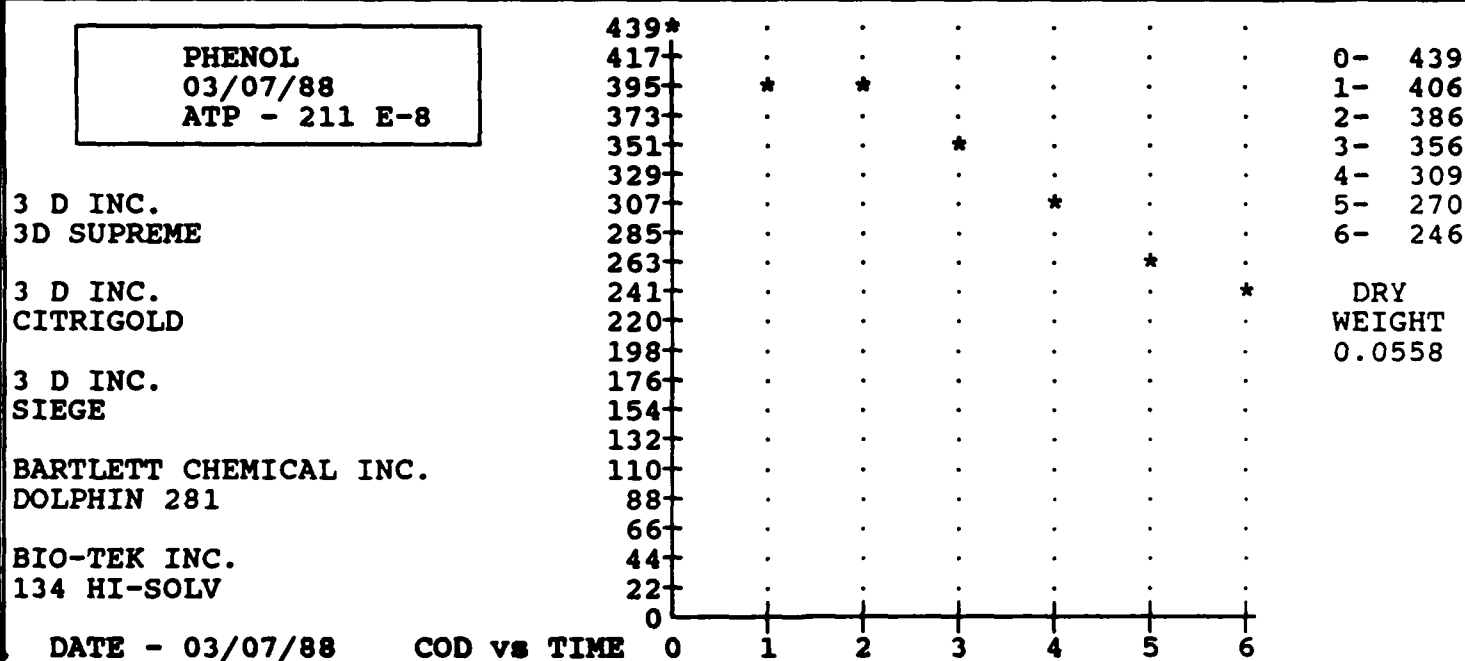
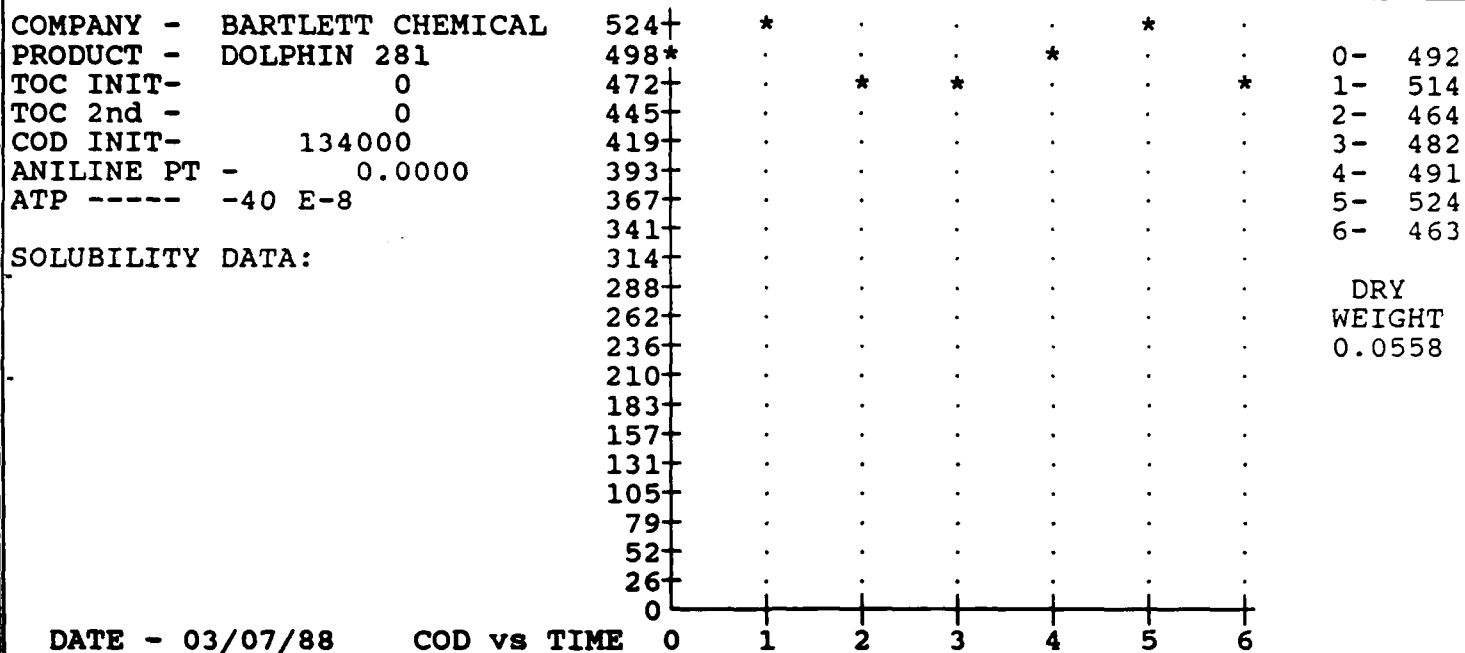
COD vs TIME

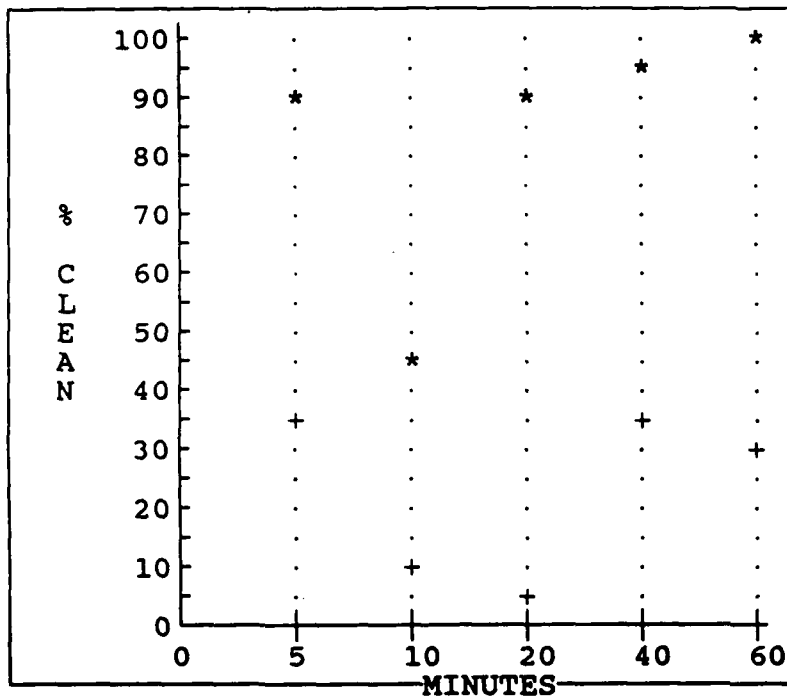
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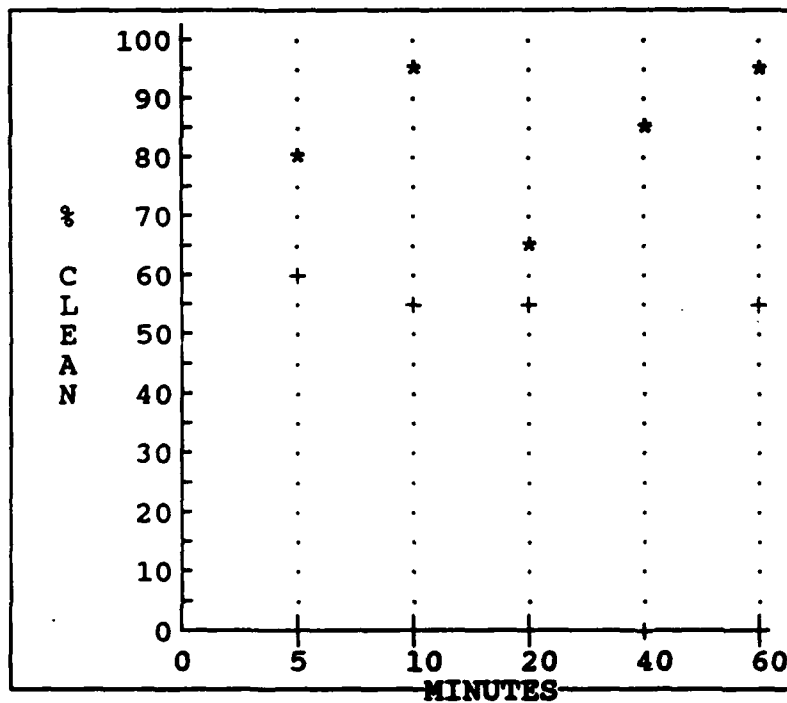


BARTLETT CHEMICAL INC.
DOLPHIN TPS CODE 219
GREASE: 1:1 AT AMBIENT

A17075

* -- RINSED
+ -- UNRINSED

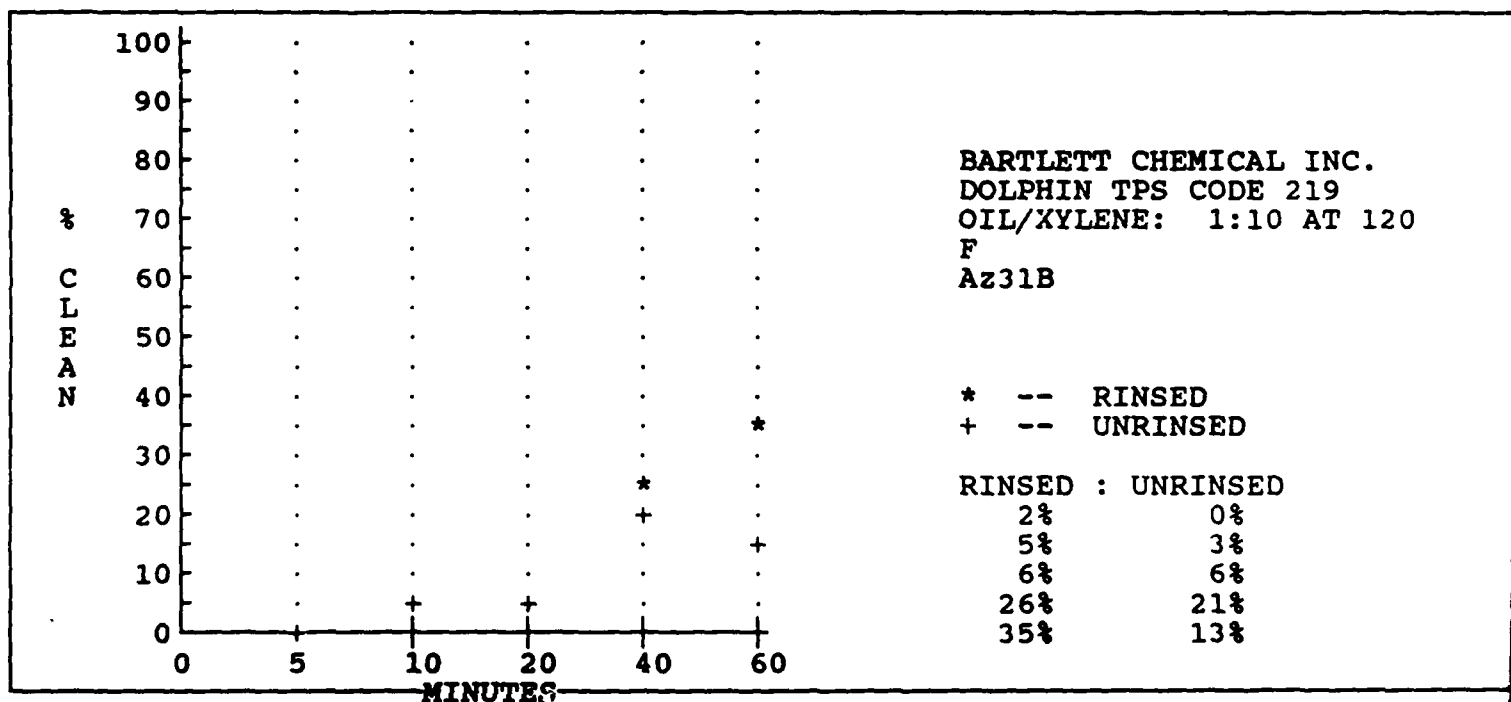
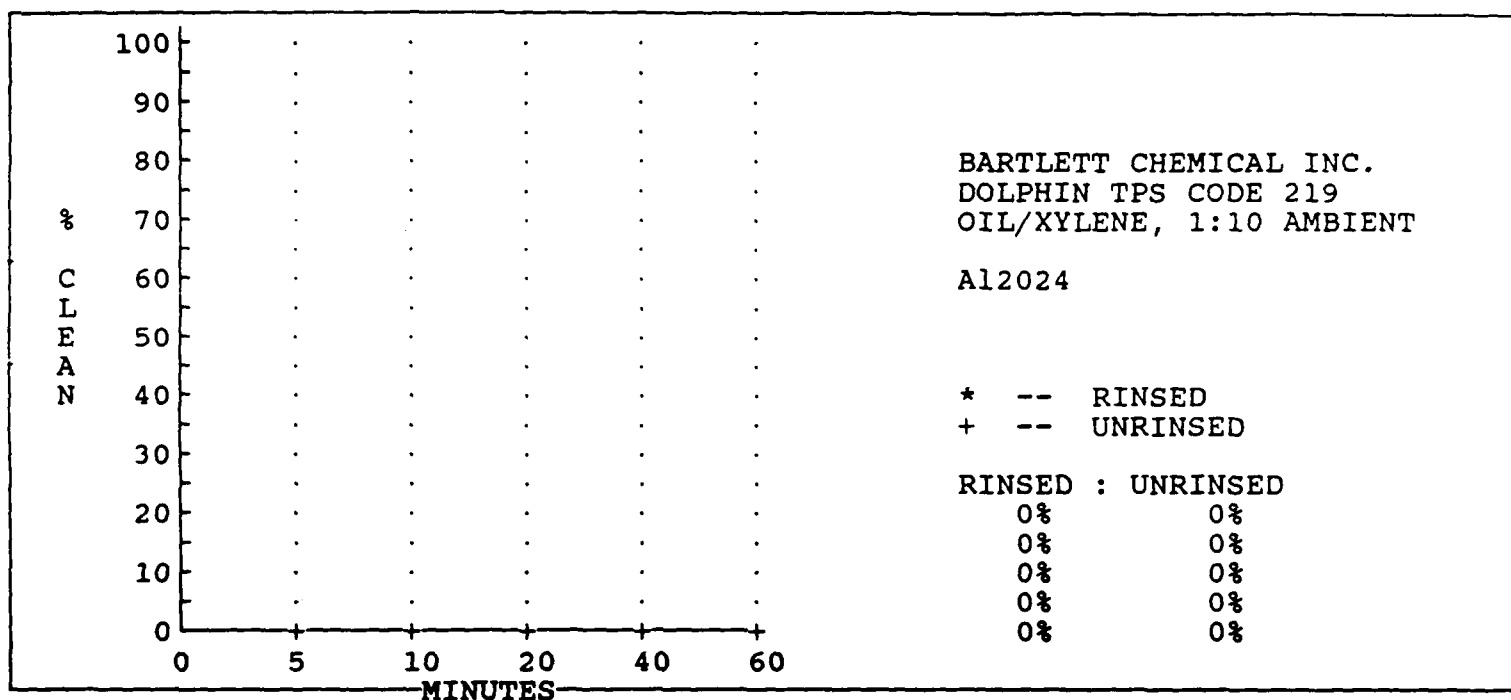
RINSED :	UNRINSED
92%	35%
44%	12%
90%	7%
95%	37%
98%	29%

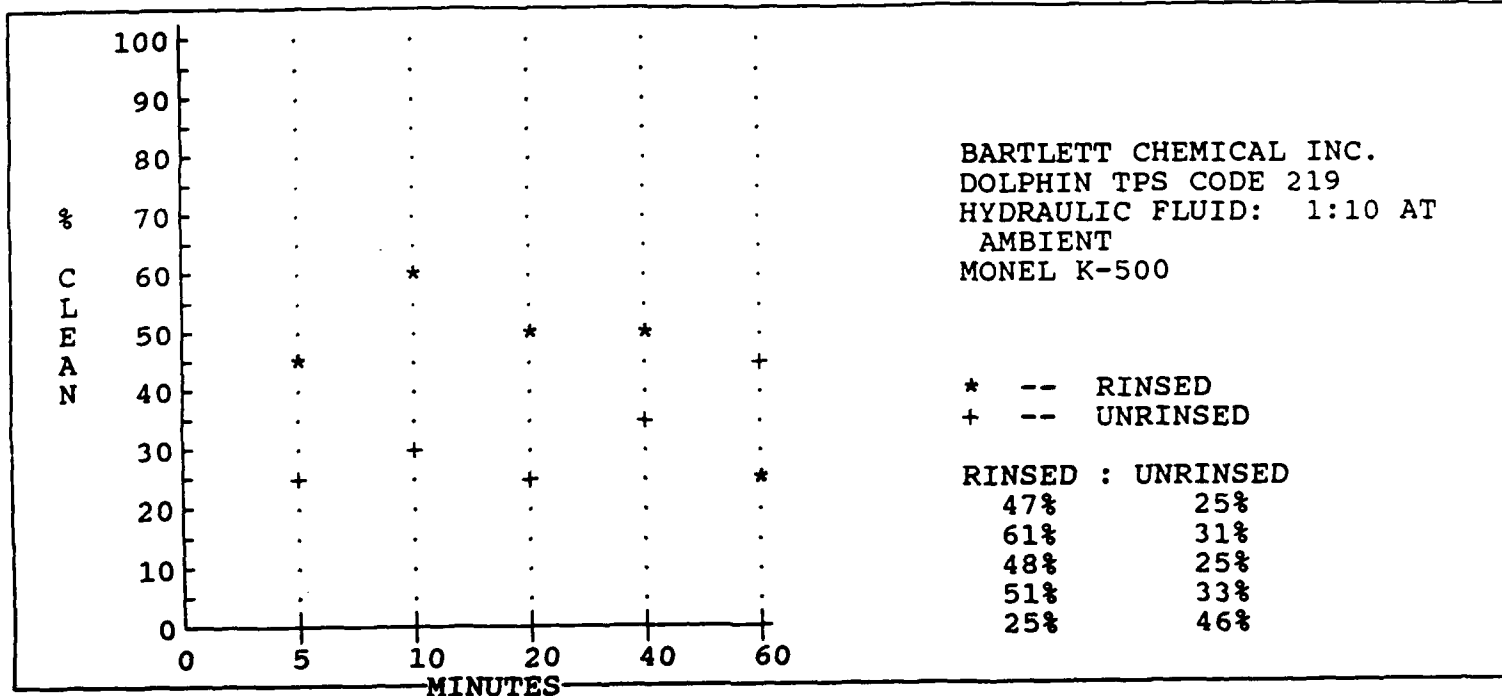


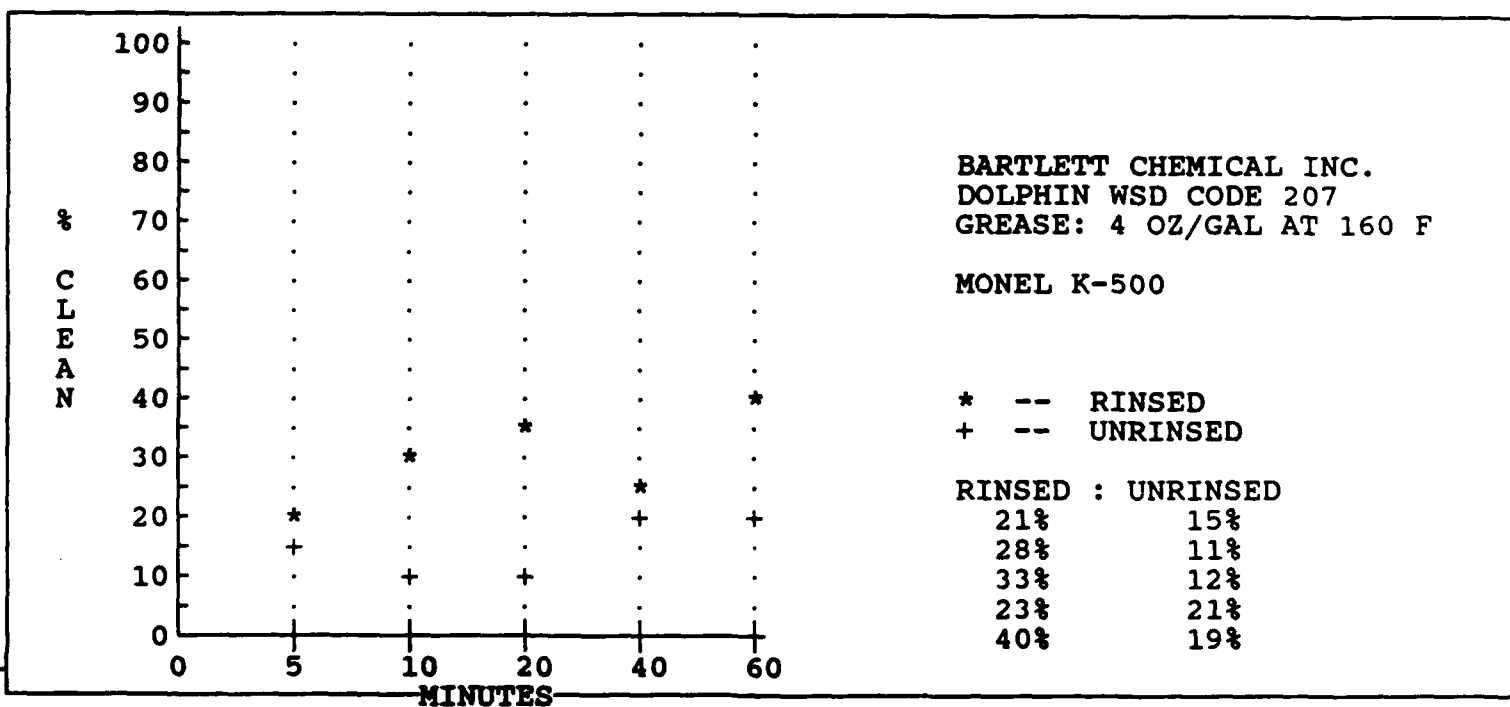
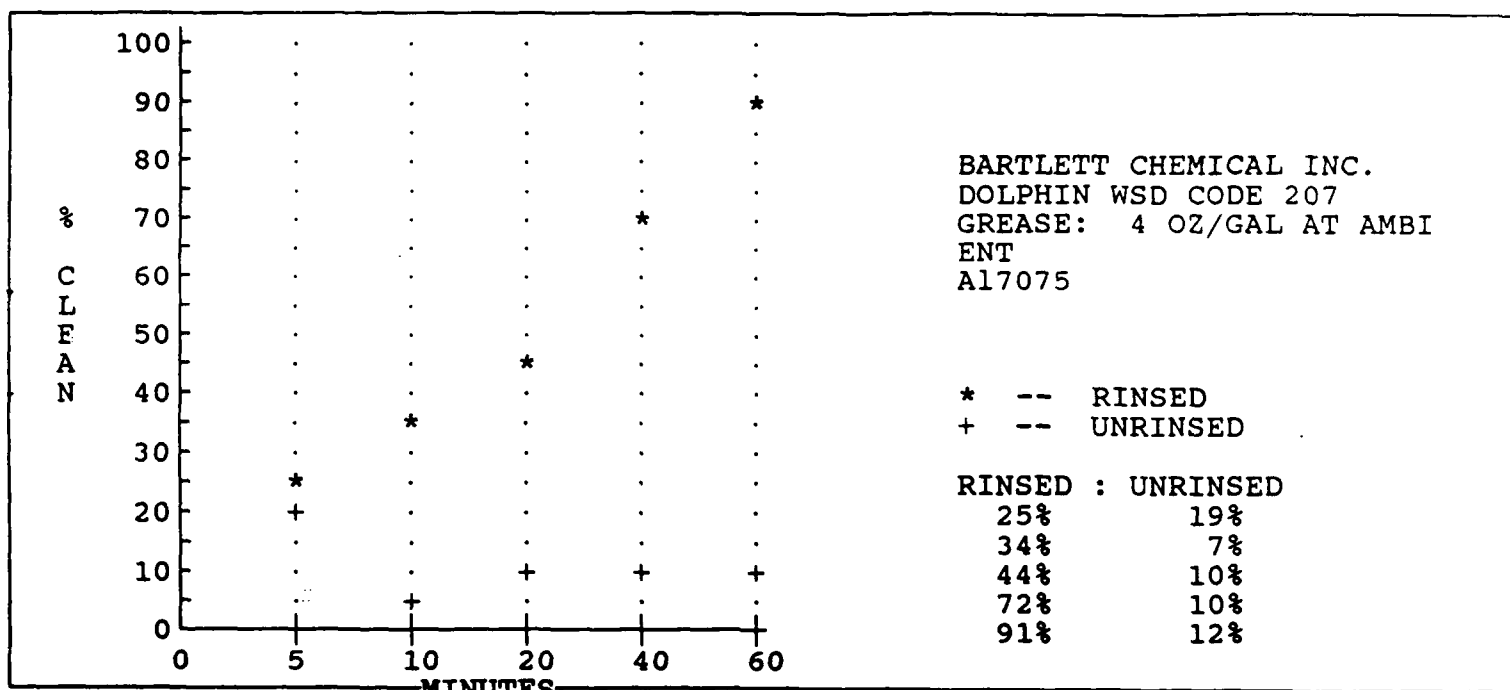
BARTLETT CHEMICAL INC.
DOLPHIN TPS CODE 219
HYDRAULIC FLUID: 1:10 AT AMBIENT
C1020

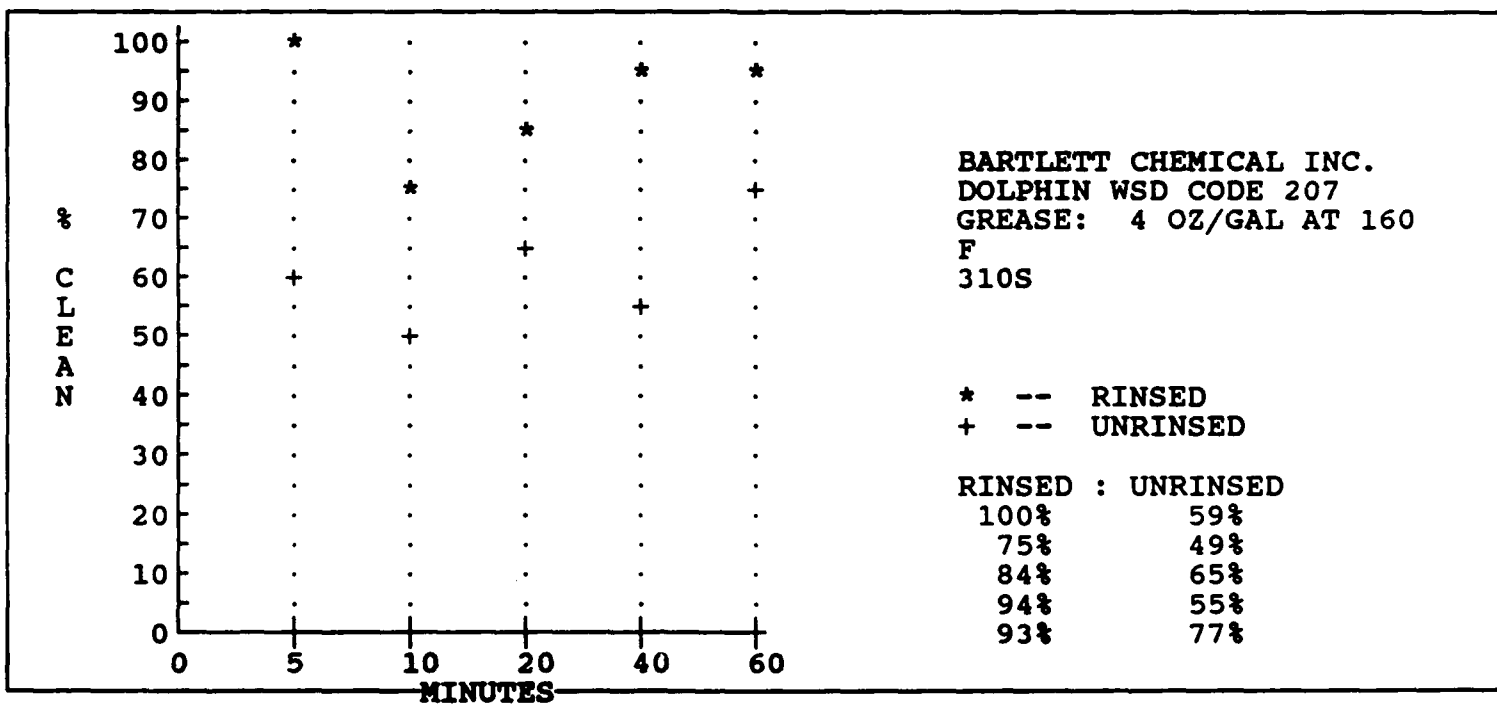
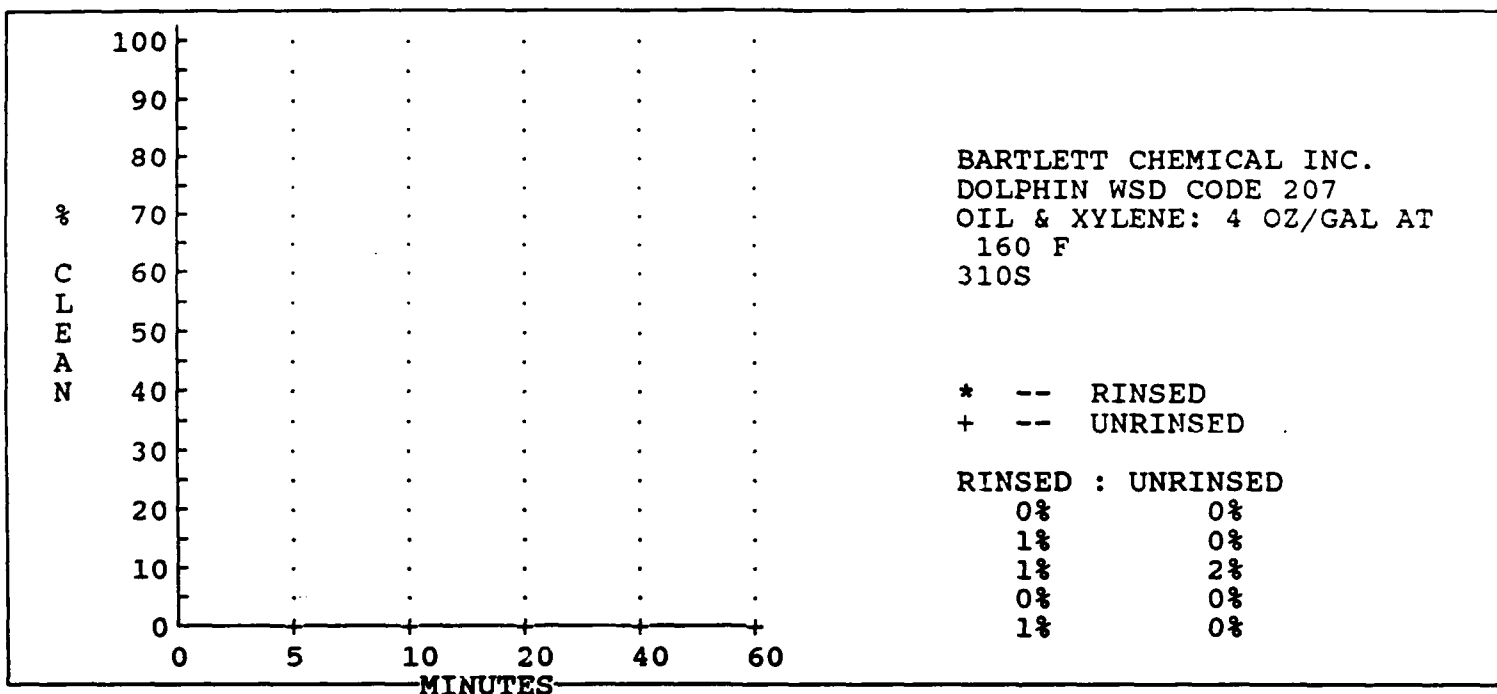
* -- RINSED
+ -- UNRINSED

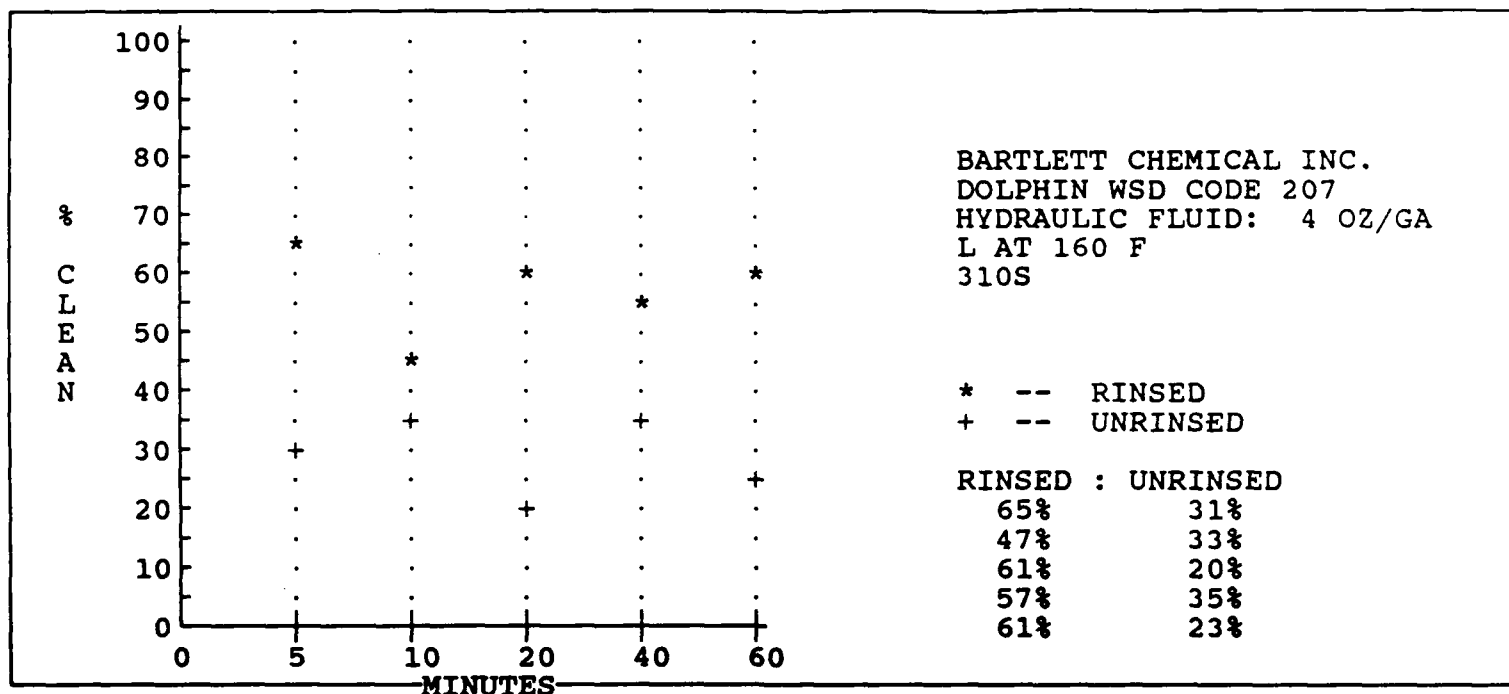
RINSED :	UNRINSED
78%	62%
93%	57%
67%	56%
83%	0%
94%	55%





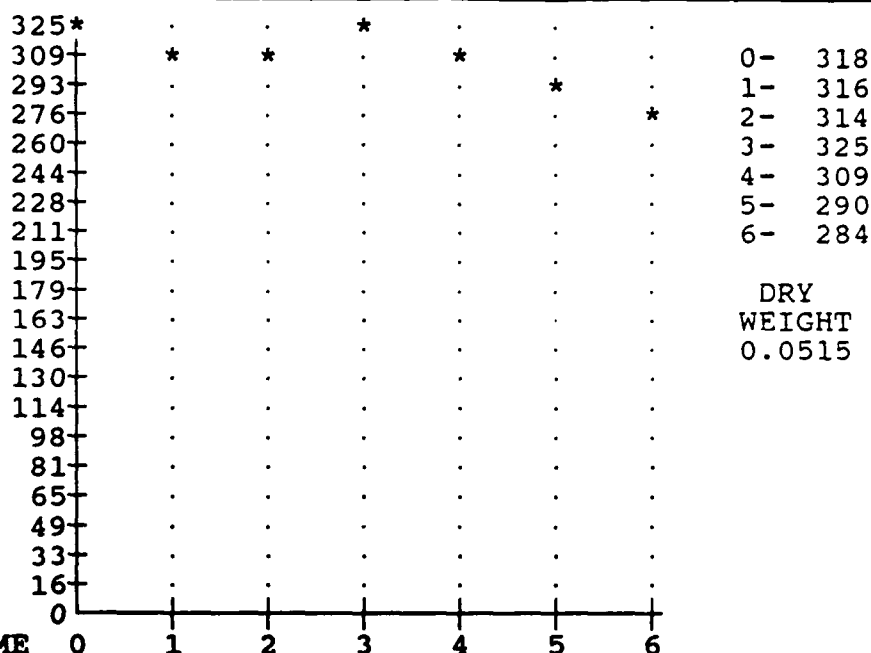






COMPANY - BARTLETT CHEMICAL
 PRODUCT - TOBY CODE 230
 TOC INIT- 10373
 TOC 2nd - 0
 COD INIT- 160500
 ANILINE PT - 0.0000
 ATP ----- 12 E-8

SOLUBILITY DATA:



DATE - 06/02/88

COD vs TIME

0 1 2 3 4 5 6

PHENOL
 06/02/88
 ATP - 90 E-8

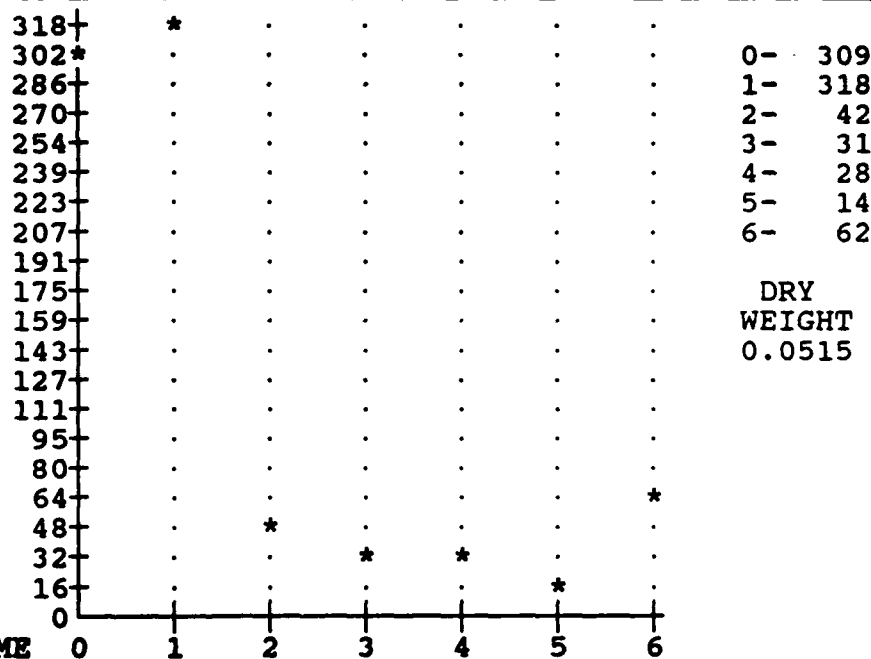
BARTLETT CHEMICAL INC.
 TOBY CODE 230

CIRCUIT CHEMISTRY CORPORA
 NCN-CU A,B

ELGENE CHEMICALS INC.
 A-CD

ELGENE CHEMICALS INC.
 SAFETY SOLVENT #10

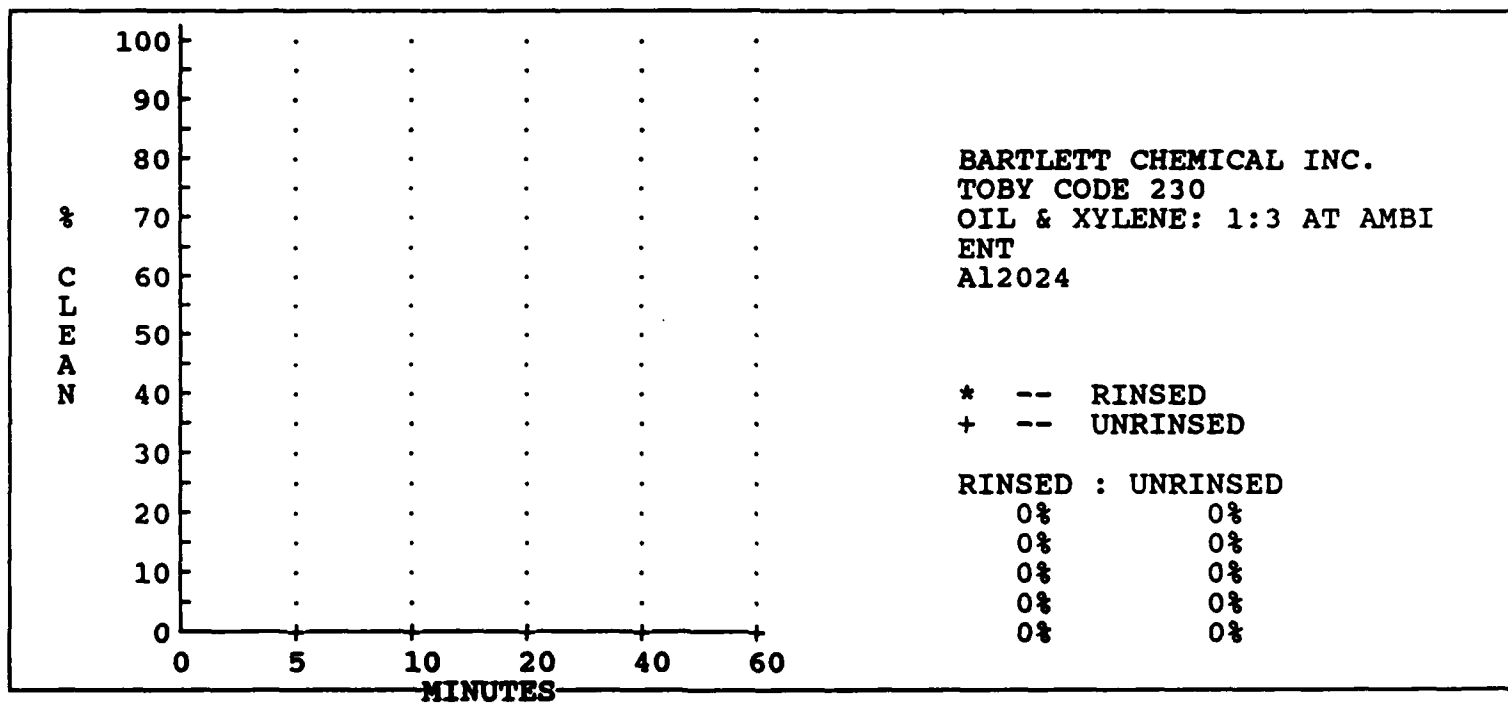
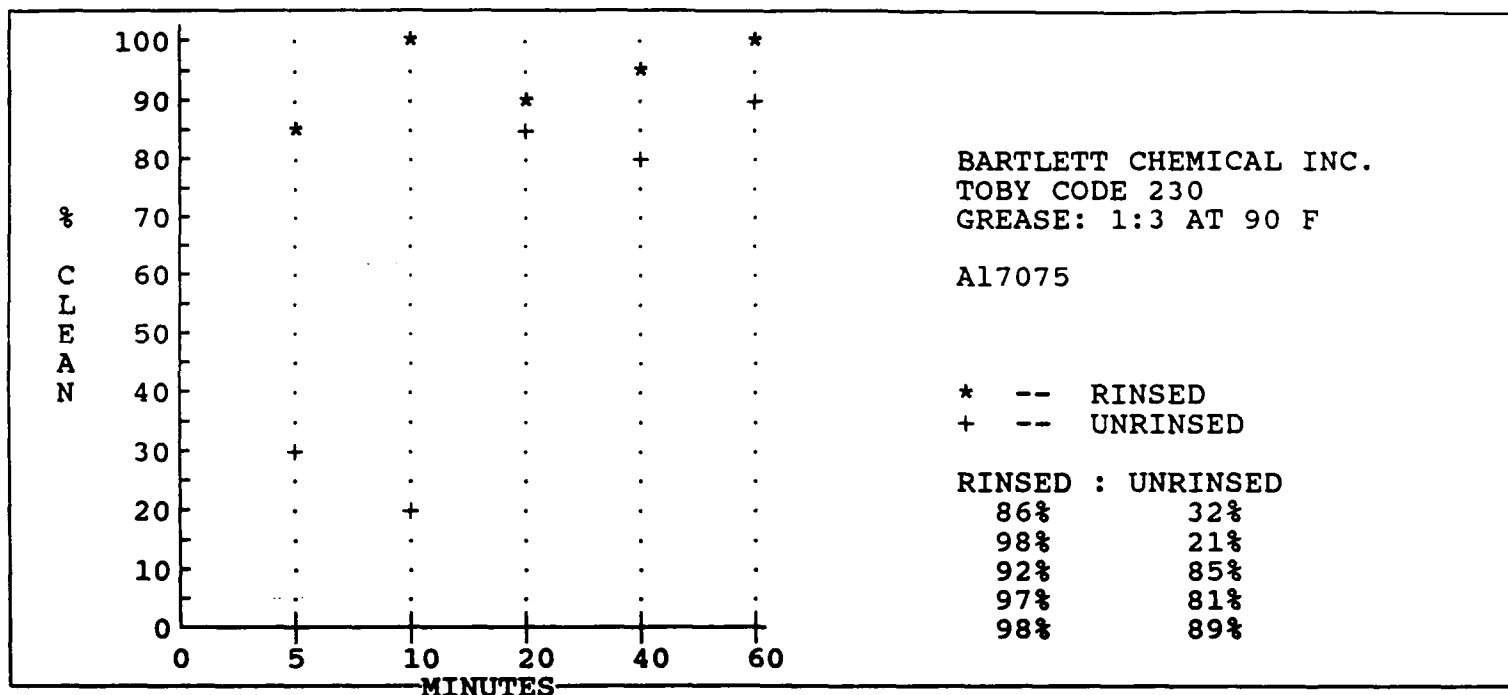
M-OIL-FREE CO.
 SERIES M

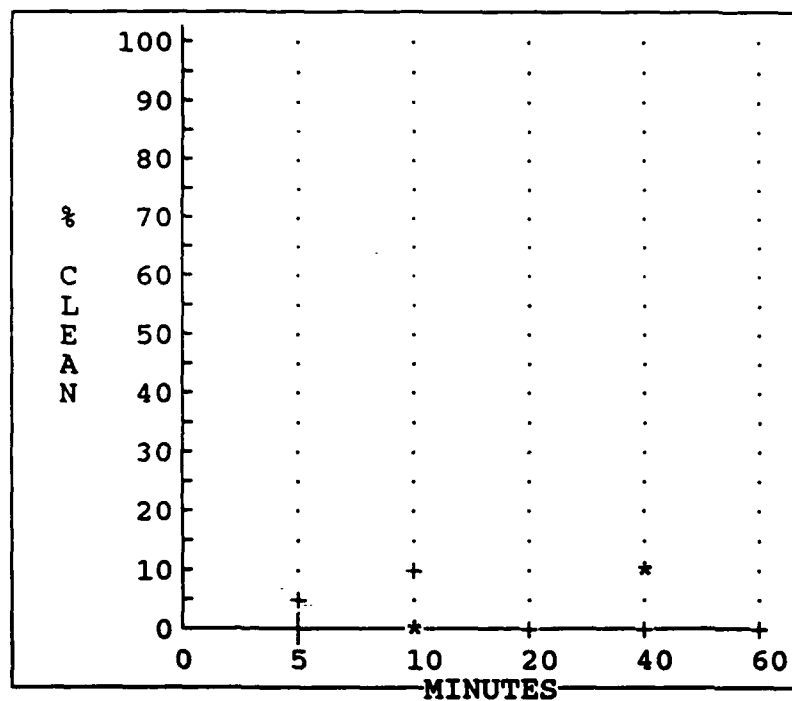


DATE - 06/02/88

COD vs TIME

0 1 2 3 4 5 6





BARTLETT CHEMICAL INC.
 TOBY CODE 230
 OIL/XYLENE: 1:3 AT 120 F

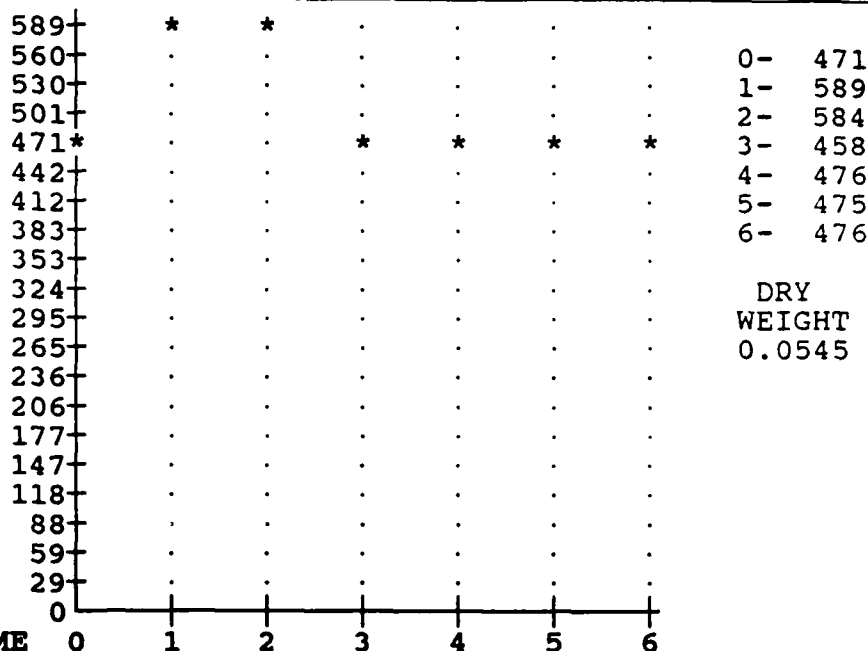
Az31B

* -- RINSED
 + -- UNRINSED

RINSED :	UNRINSED
3%	6%
2%	9%
3%	1%
11%	0%
1%	0%

COMPANY - BIO-TEK INC.
 PRODUCT - 122 QUIK
 TOC INIT- 20557
 TOC 2nd - 0
 COD INIT- 2125000
 ANILINE PT - 0.0000
 ATP ----- -27 E-8

SOLUBILITY DATA:



DATE - 06/14/88

COD vs TIME

PHENOL
 06/14/88
 ATP - 91 E-8

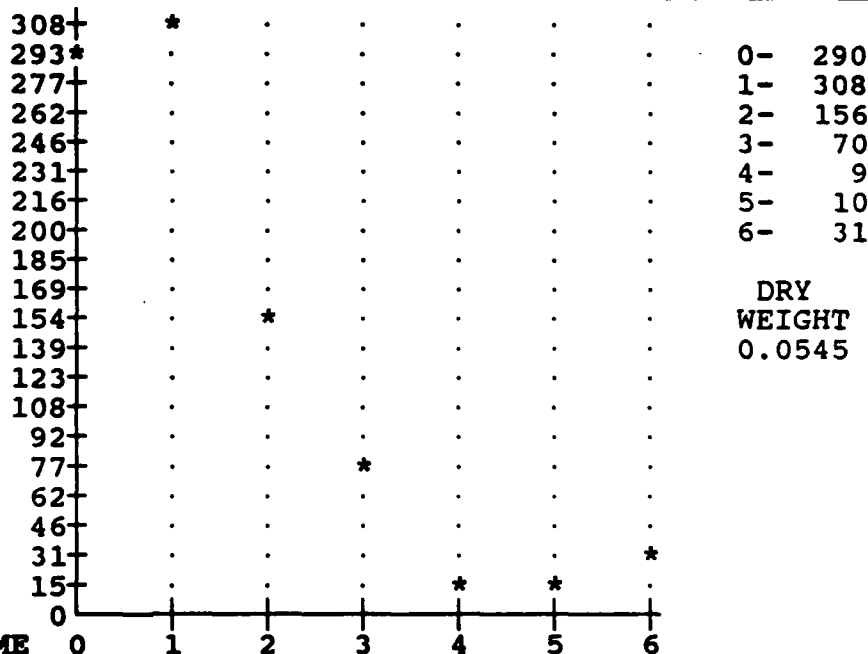
BIO-TEK INC.
 122 QUIK

BIO-TEK INC.
 126 SONI-CLEAN

BRULIN
 FORMULA 512M

BUILD ALL
 BAC #137

HYLUBE INC.
 ALKAKLEEN 658



DATE - 06/14/88

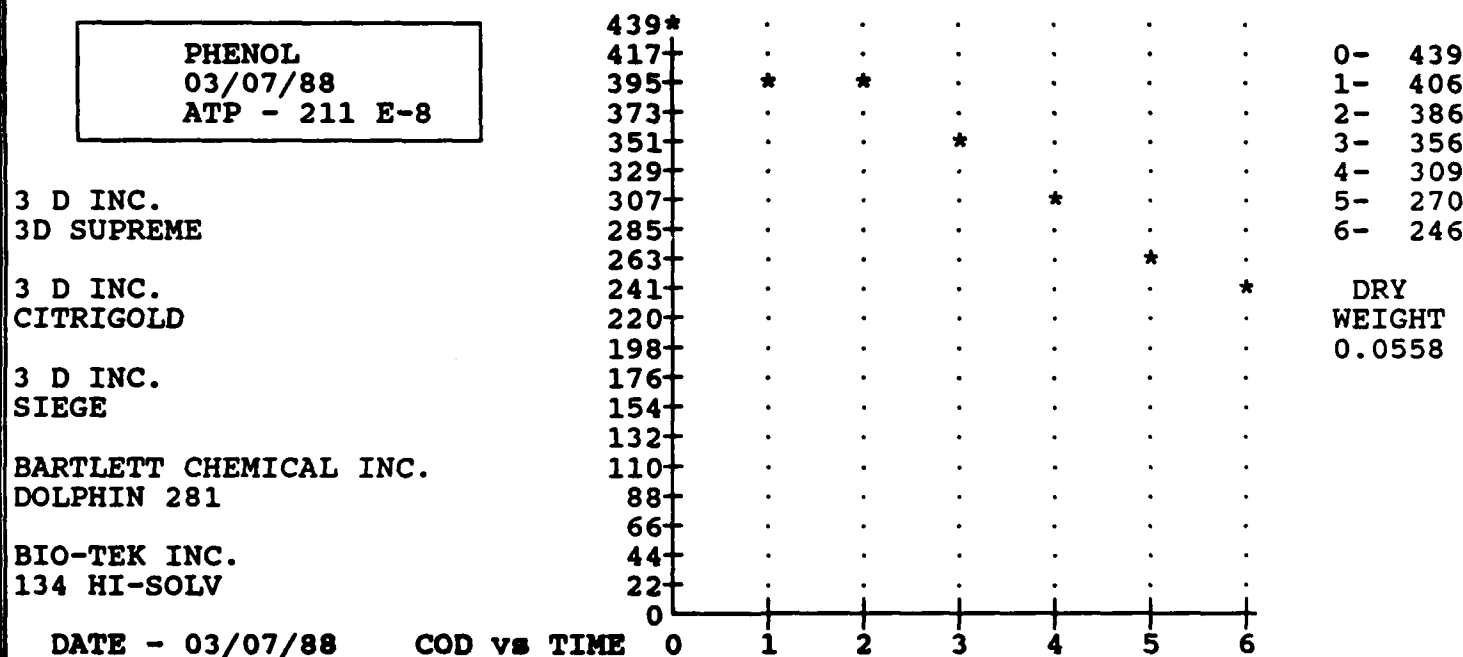
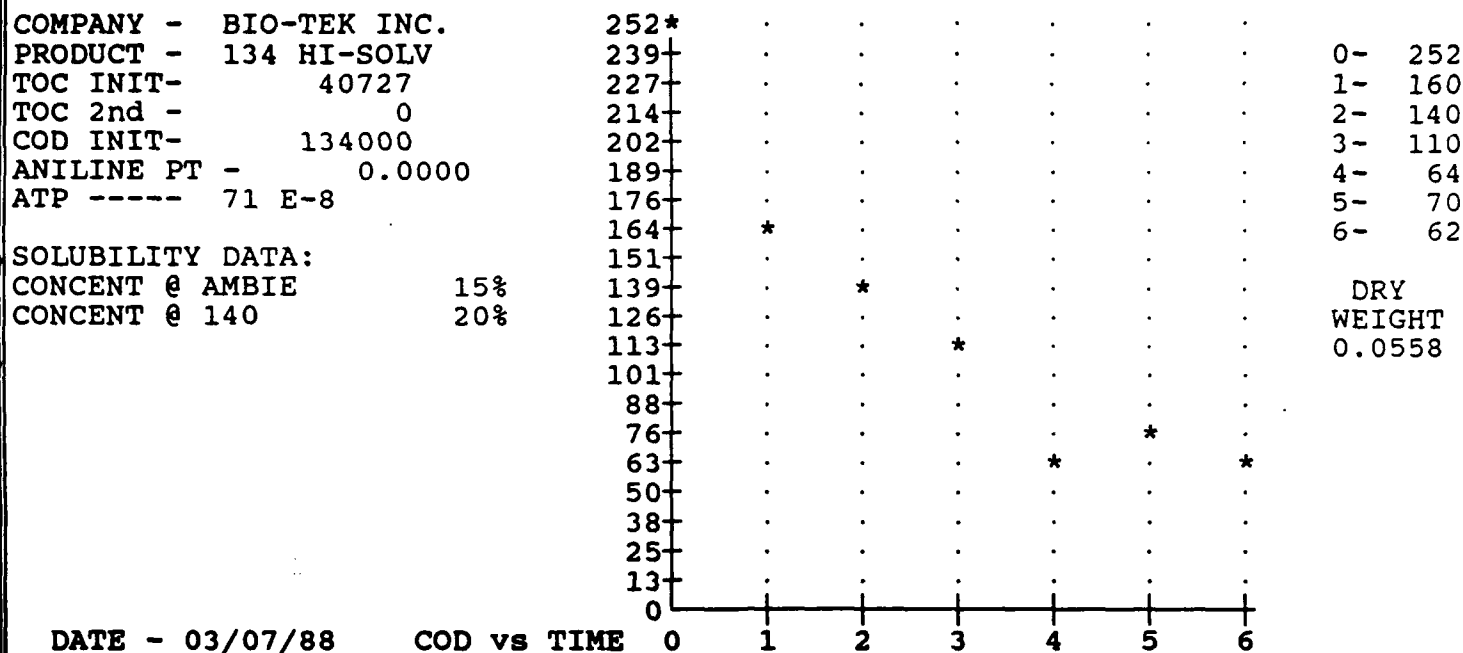
COD vs TIME

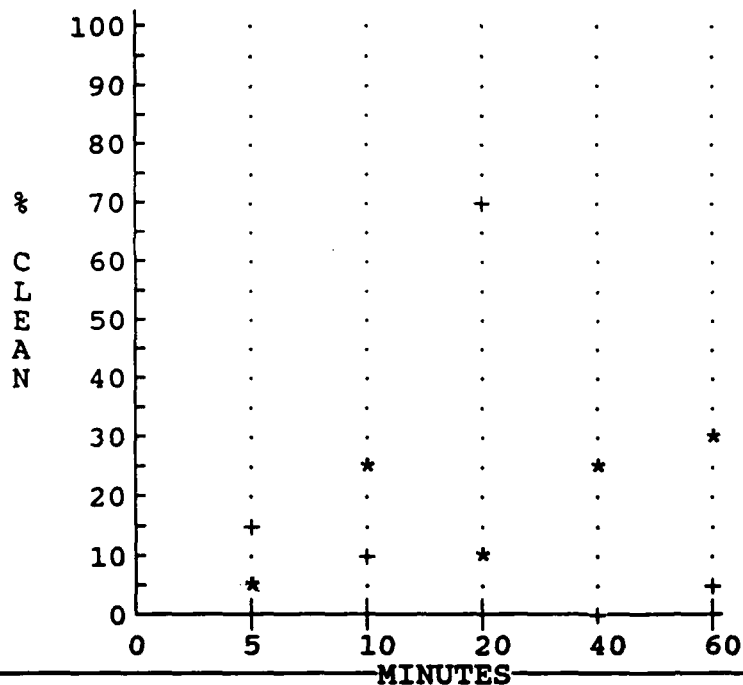
COMPANY - BIO-TEK INC.	775	*	*	.	.	.	.
PRODUCT - 126 SONI-CLEAN	736	.	.	.	*	.	*	0- 696
TOC INIT- 71182	698*	.	.	*	.	*	.	1- 757
TOC 2nd - 0	659	.	.	.	.	.	.	2- 775
COD INIT- 33900	620	.	.	.	.	.	.	3- 694
ANILINE PT - 0.0000	581	.	.	.	.	.	.	4- 718
ATP ----- -14 E-8	543	.	.	.	.	.	.	5- 714
	504	.	.	.	.	.	.	6- 744
SOLUBILITY DATA:	465	.	.	.	.	.	.
	426	.	.	.	.	.	.
	388	.	.	.	.	.	.	DRY
	349	.	.	.	.	.	.	WEIGHT
	310	.	.	.	.	.	.	0.0545
	271	.	.	.	.	.	.
	233	.	.	.	.	.	.
	194	.	.	.	.	.	.
	155	.	.	.	.	.	.
	116	.	.	.	.	.	.
	78	.	.	.	.	.	.
	39	.	.	.	.	.	.
	0	.	.	.	.	.	.

DATE - 06/14/88 COD vs TIME 0 1 2 3 4 5 6

<div style="border: 1px solid black; padding: 5px; display: inline-block;"> PHENOL 06/14/88 ATP - 91 E-8 </div>	308	*	.	.	.	.	.
	293*	.	.	.	.	.	.	0- 290
	277	.	.	.	.	.	.	1- 308
	262	.	.	.	.	.	.	2- 156
	246	.	.	.	.	.	.	3- 70
	231	.	.	.	.	.	.	4- 9
BIO-TEK INC.	216	.	.	.	.	.	.	5- 10
122 QUIK	200	.	.	.	.	.	.	6- 31
	185	.	.	.	.	.	.
BIO-TEK INC.	169	.	.	.	.	.	.	DRY
126 SONI-CLEAN	154	.	*	.	.	.	.	WEIGHT
	139	.	.	.	.	.	.	0.0545
BRULIN	123	.	.	.	.	.	.
FORMULA 512M	108	.	.	.	.	.	.
	92	.	.	.	.	.	.
BUILD ALL	77	.	.	*	.	.	.	
BAC #137	62	.	.	.	.	.	.
	46	.	.	.	.	.	.
HYLUBE INC.	31	.	.	.	.	.	*
ALKAKLEEN 658	15	.	.	.	*	*	.	
	0	.	.	.	.	.	.

DATE - 06/14/88 COD vs TIME 0 1 2 3 4 5 6



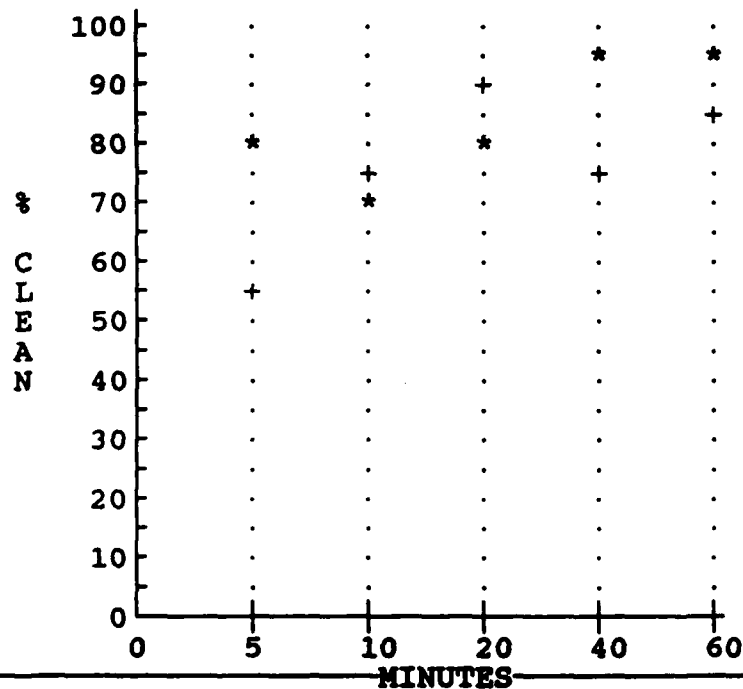


BIO-TEK INC.
134 HI-SOLV
CONCENTRATED, AMBIENT

A17075

* -- RINSED
+ -- UNRINSED

RINSED :	UNRINSED
7%	15%
24%	8%
11%	68%
25%	1%
28%	4%

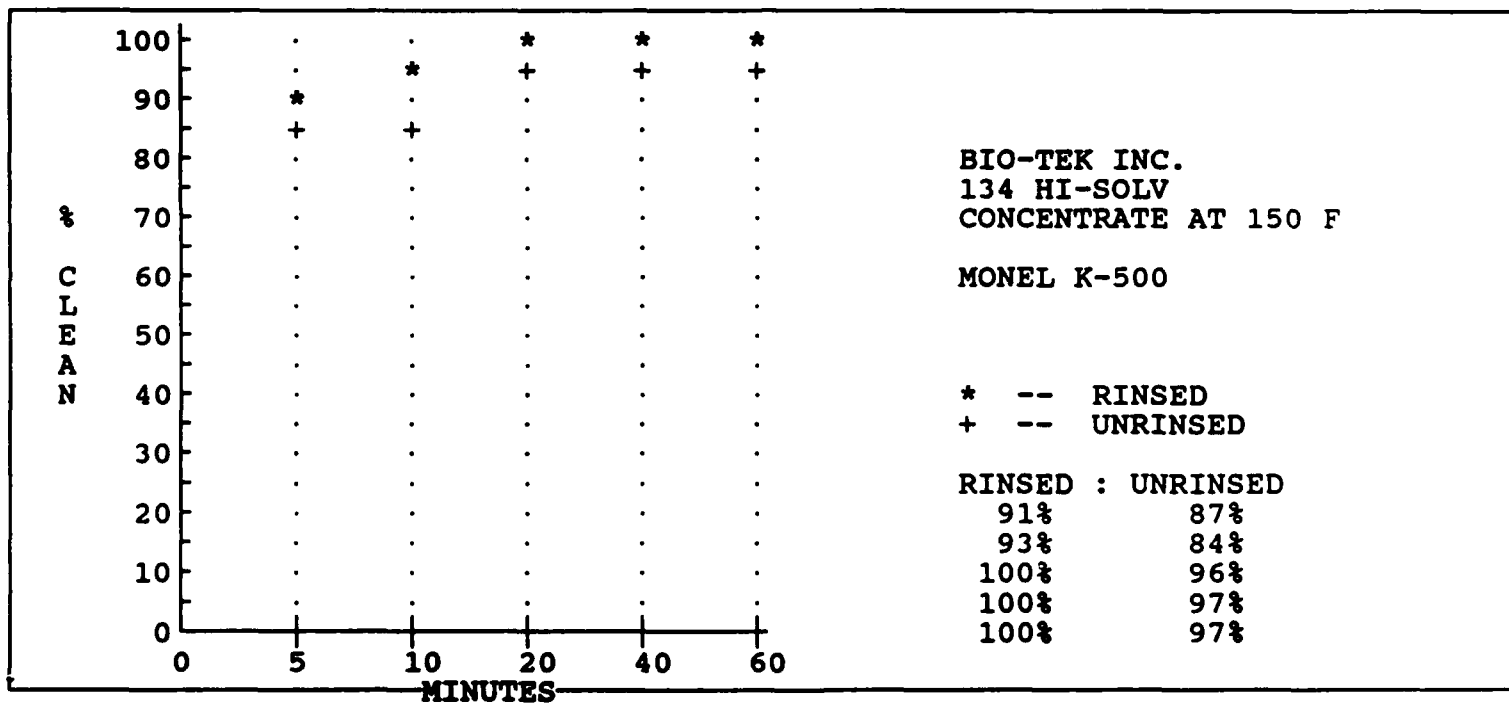
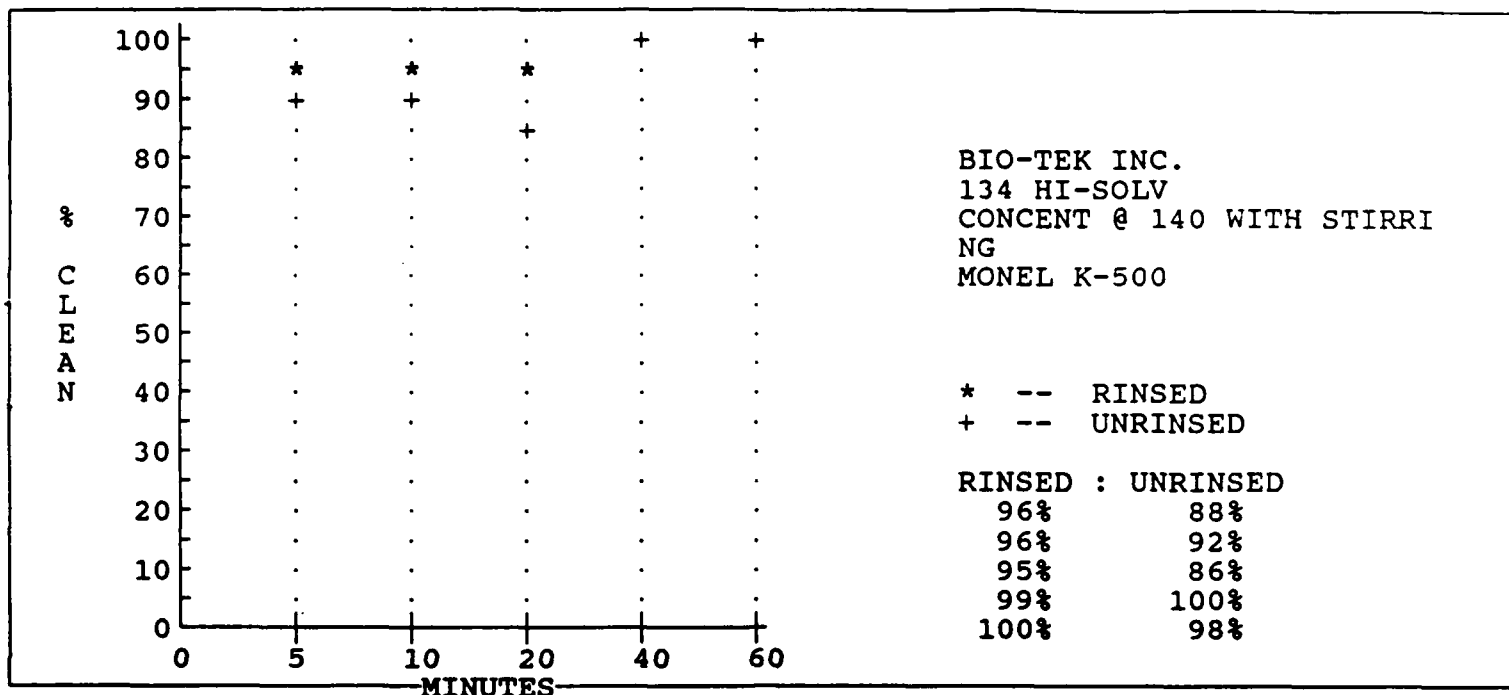


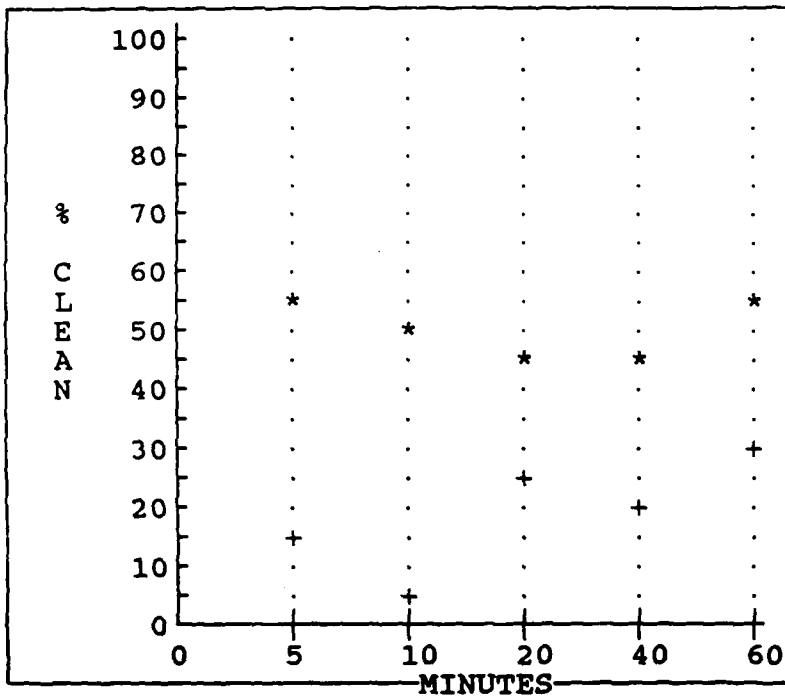
BIO-TEK INC.
134 HI-SOLV
CONCENTRATED, 140 F

A12024

* -- RINSED
+ -- UNRINSED

RINSED :	UNRINSED
81%	54%
69%	73%
79%	89%
95%	76%
97%	83%

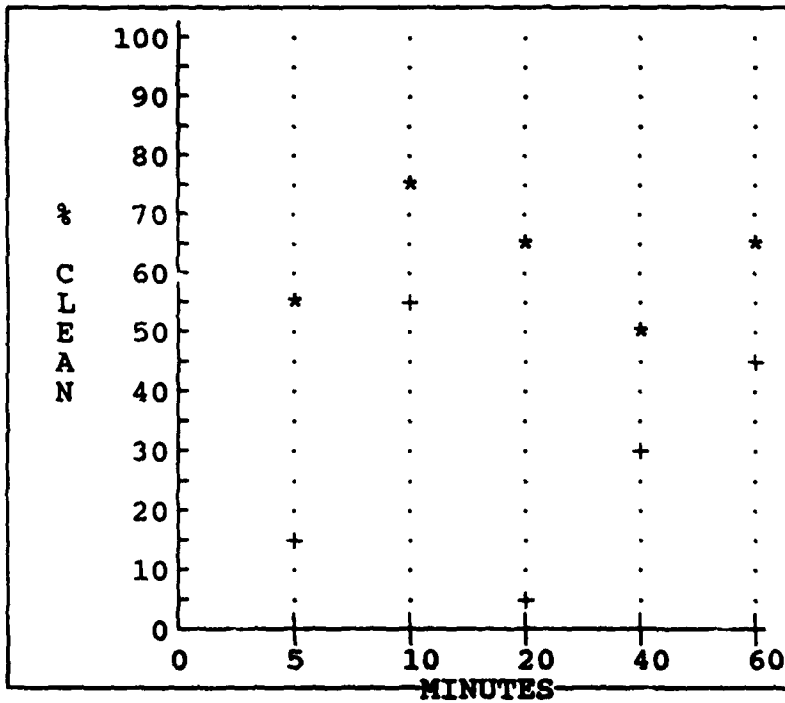




BIO-TEK INC.
134 HI-SOLV
GREASE: CONCENTRATE AT AM
BIENT
A12024

* -- RINSED
+ -- UNRINSED

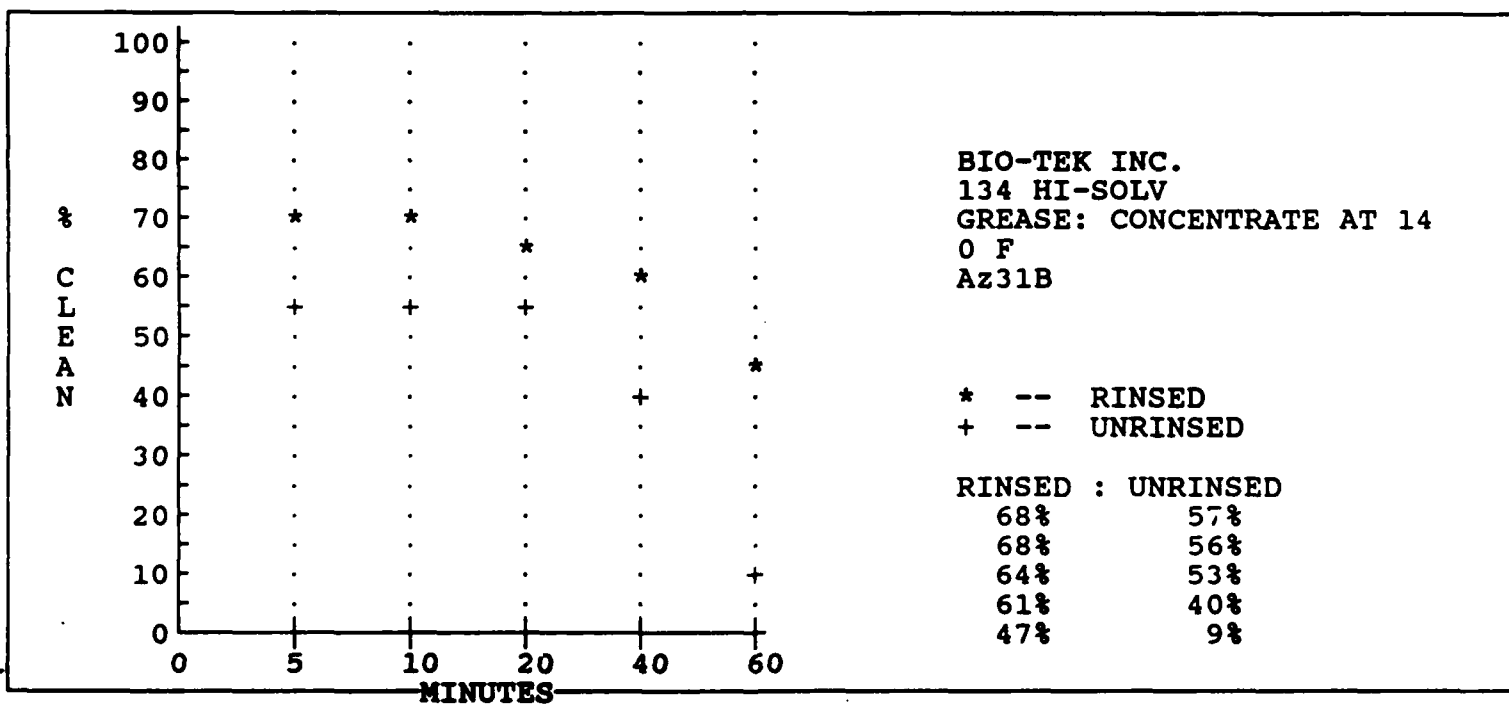
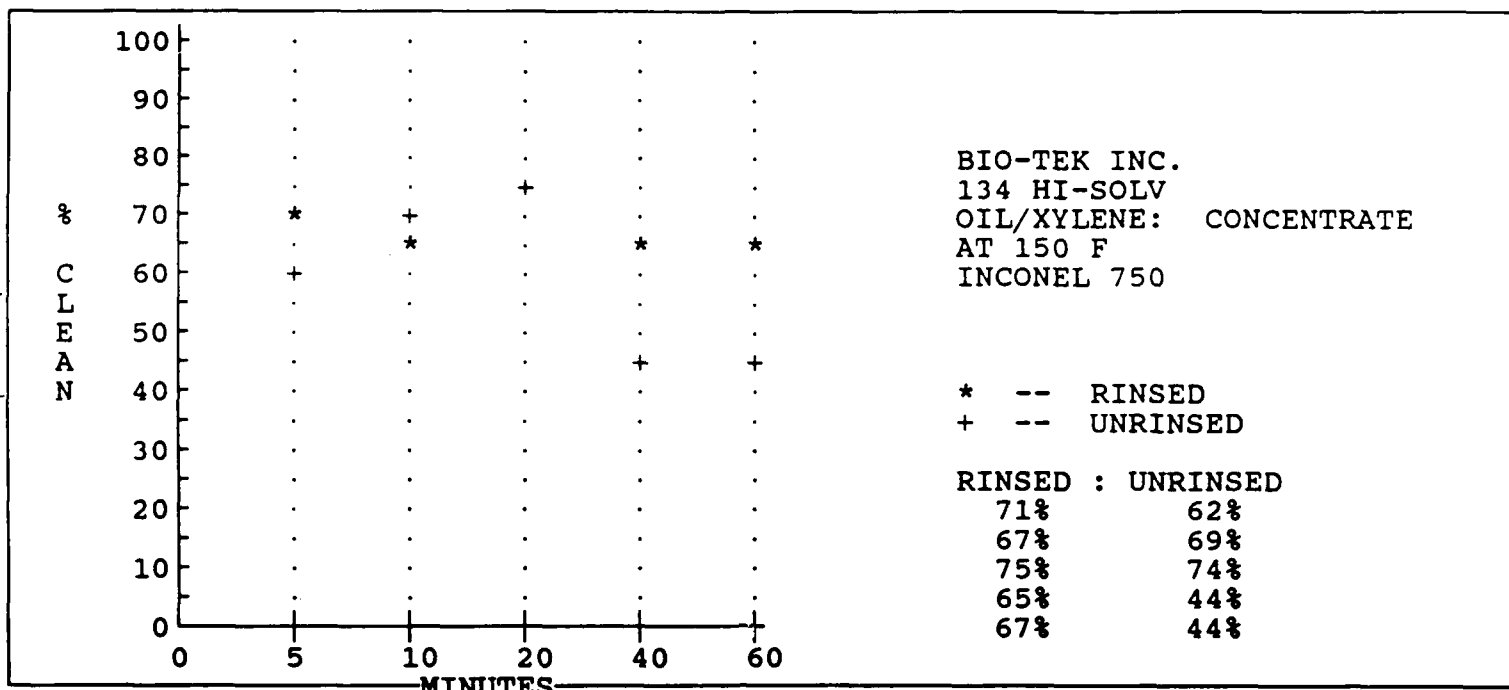
RINSED :	UNRINSED
56%	16%
52%	6%
43%	25%
46%	22%
56%	28%

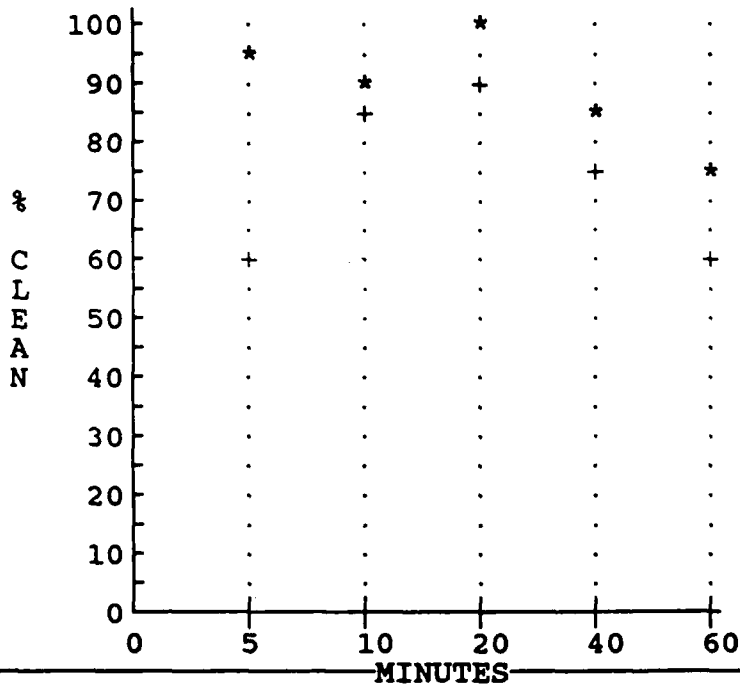


BIO-TEK INC.
134 HI-SOLV
OIL/XYLENE: CONCENTRATE
AT 140 F
C1020

* -- RINSED
+ -- UNRINSED

RINSED :	UNRINSED
56%	15%
75%	55%
63%	5%
52%	29%
64%	47%





BIO-TEK INC.
 134 HI-SOLV
 HYDRAULIC FLUID: CONCENT
 RATE AT 140 F
 A17075

* -- RINSED
 + -- UNRINSED

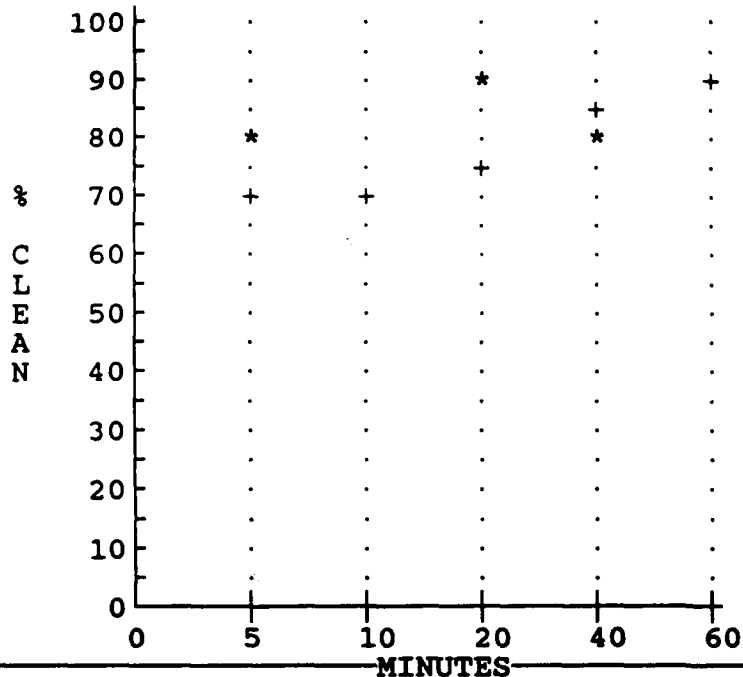
RINSED : UNRINSED	
95%	61%
91%	84%
100%	91%
87%	76%
74%	61%

COMPANY - BIO-TEK INC.	76	.	.	.	*	.	.	
PRODUCT - SAFTEY SOLVENT DEG	72	.	.	.	.	.	.	0- 64
TOC INIT- 107185	68	.	.	.	.	.	.	1- 60
TOC 2nd - 0	65*	.	.	.	.	.	.	2- 32
COD INIT- 59000	61	*	.	.	.	.	.	3- -7
ANILINE PT - 0.0000	57	.	.	.	.	.	.	4- 76
ATP ----- -46 E-8	53	.	.	.	.	*	*	5- 54
	49	.	.	.	.	.	.	6- 55
	46	.	.	.	.	.	.
SOLUBILITY DATA:	42	.	.	.	.	.	.
CONCENT @ AMBIE 12%	38	.	.	.	.	.	.	DRY
CONCENT @ 140 79%	34	.	.	.	.	.	.	WEIGHT
	30	.	*	.	.	.	.	0.0678
	27	.	.	.	.	.	.
	23	.	.	.	.	.	.
	19	.	.	.	.	.	.
	15	.	.	.	.	.	.
	11	.	.	.	.	.	.
	8	.	.	.	.	.	.
	4	.	.	.	.	.	.
	0	.	.	.	.	.	.

DATE - 03/08/88 COD vs TIME 0 1 2 3 4 5 6

<div style="border: 1px solid black; padding: 5px; display: inline-block;"> PHENOL 03/08/88 ATP - 30 E-8 </div>	307*	.	.	.	.	.	.
	292	.	.	.	.	.	.	0- 307
	276	*	.	.	.	.	.	1- 276
	261	.	.	.	.	.	.	2- 209
	246	.	.	.	.	.	.	3- 174
	230	.	.	.	.	.	.	4- 156
BIO-TEK INC.	215	.	*	.	.	.	.	5- 108
SAFTEY SOLVENT DEGREASER	200	.	.	.	.	.	.	6- 88
	184	.	.	.	.	.	.
BRULIN	169	.	.	*	.	.	.	DRY
AQUA SAFE	154	.	.	.	*	.	.	WEIGHT
	138	.	.	.	.	.	.	0.0678
BRULIN	123	.	.	.	.	.	.
NATURE-SOL 100	107	.	.	.	.	*	.
	92	.	.	.	.	.	*
CALLA CHEMICAL CORP	77	.	.	.	.	.	.
CALLA 301-A-LEMON	61	.	.	.	.	.	.
	46	.	.	.	.	.	.
CROWLEY CHEMICAL COMPANY	31	.	.	.	.	.	.
METHYL NAPHTHALENE #5	15	.	.	.	.	.	.
	0	.	.	.	.	.	.

DATE - 03/08/88 COD vs TIME 0 1 2 3 4 5 6



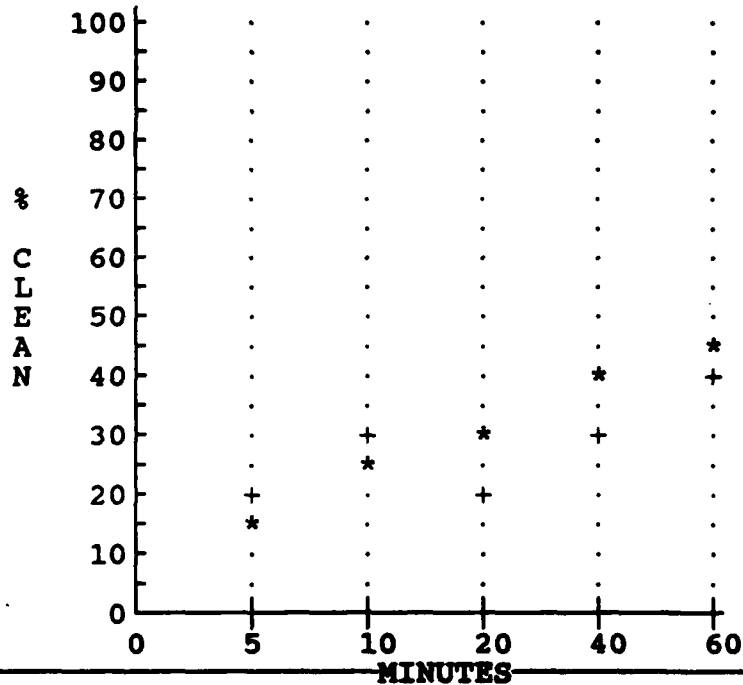
BIO-TEK INC.
SAFTEY SOLVENT DEGREASER
CONCENTRATED, 140 F

A12024

* -- RINSED
+ -- UNRINSED

RINSED : UNRINSED

79%	69%
69%	70%
89%	73%
81%	88%
91%	89%



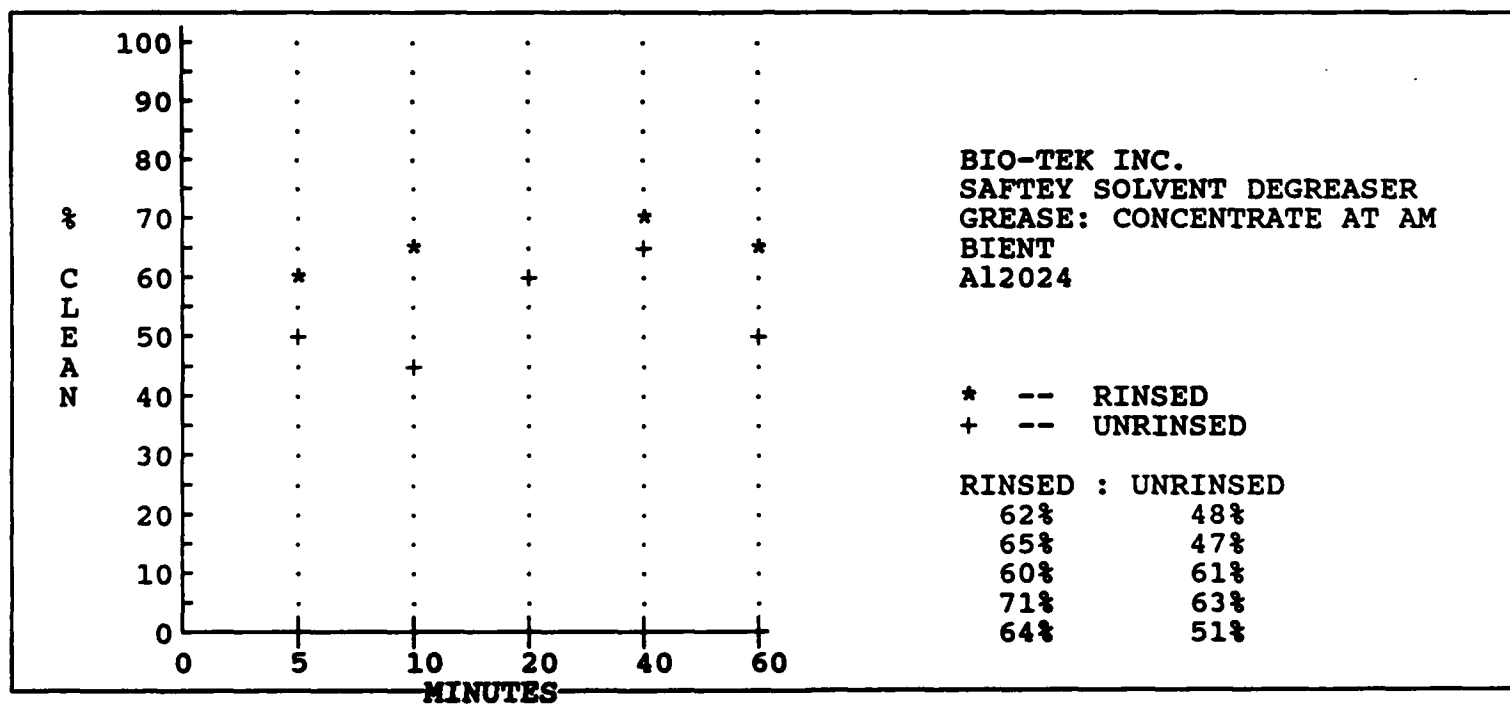
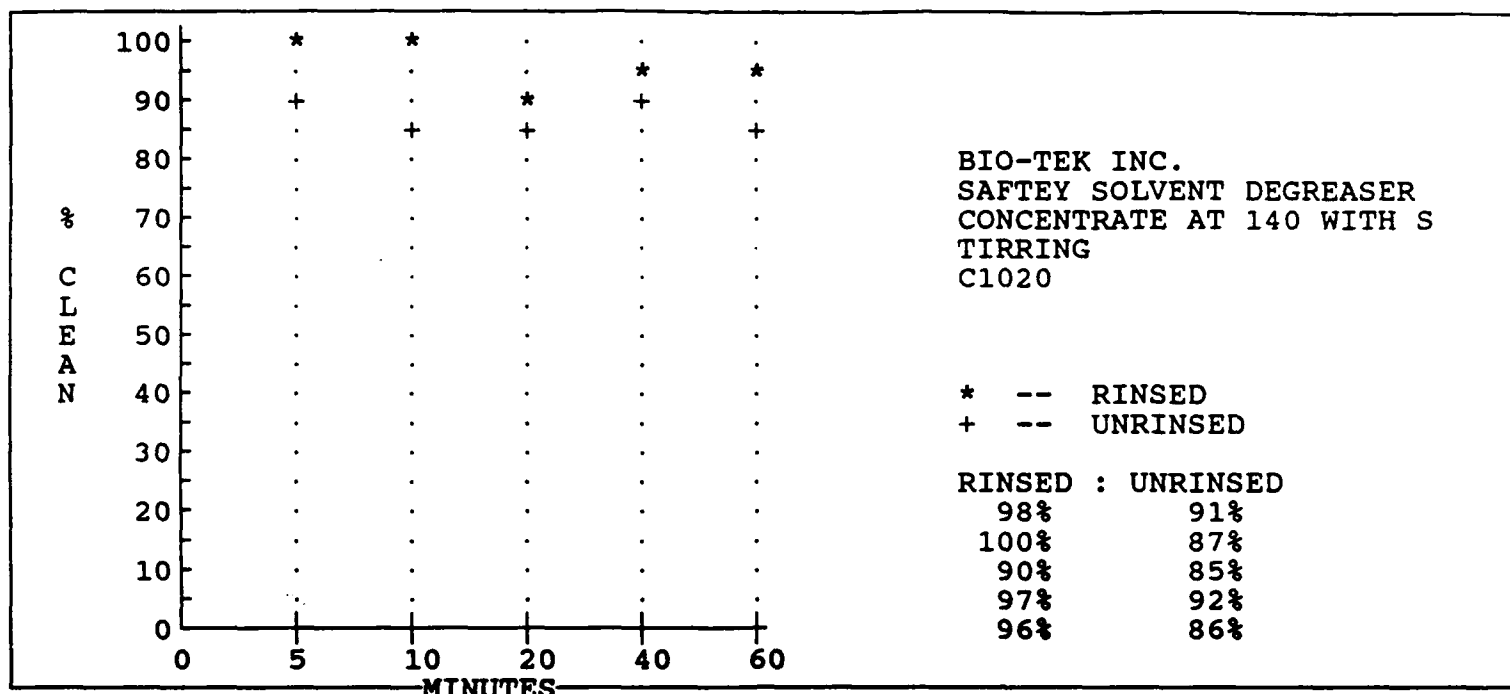
BIO-TEK INC.
SAFTEY SOLVENT DEGREASER
CONCENTRATED, AMBIENT

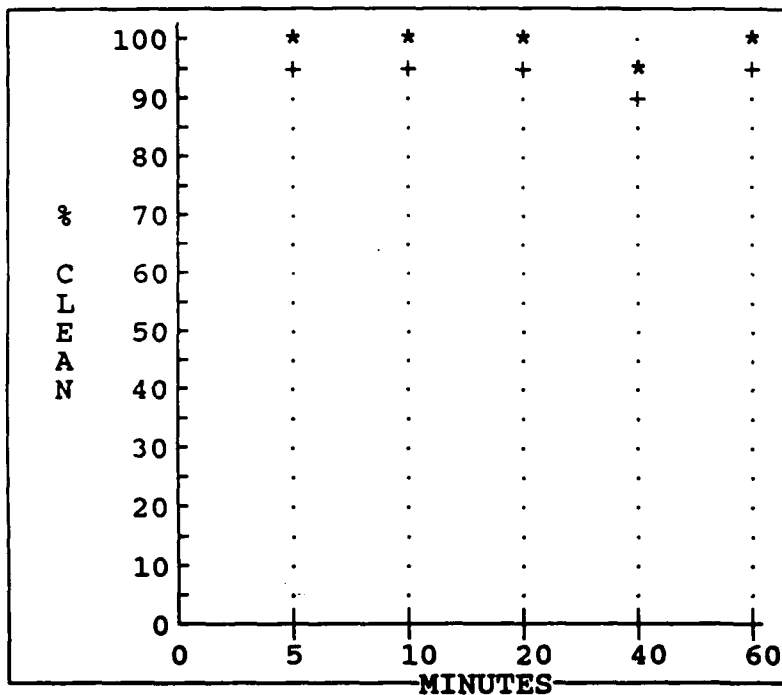
A17075

* -- RINSED
+ -- UNRINSED

RINSED : UNRINSED

15%	18%
23%	30%
32%	21%
41%	32%
44%	42%

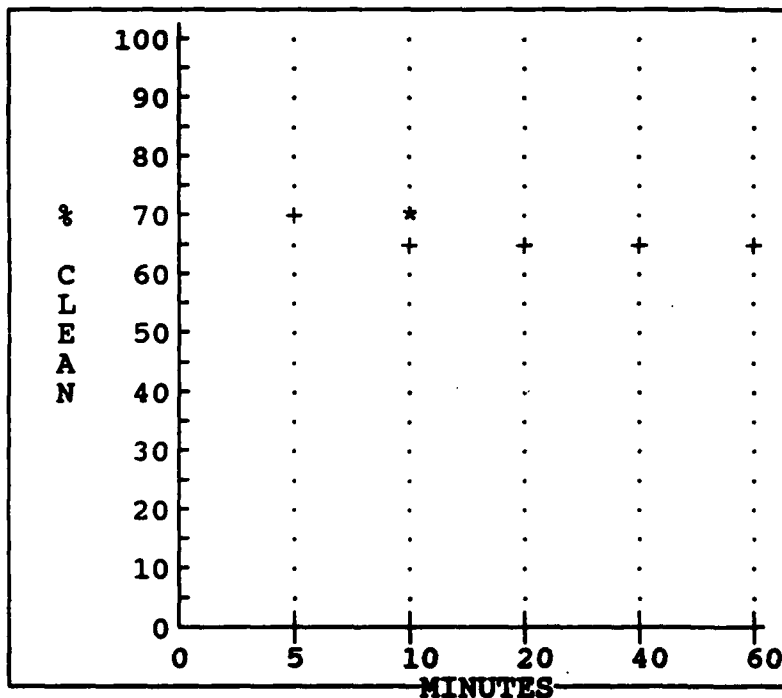




BIO-TEK INC.
SAFTEY SOLVENT DEGREASER
OIL/XYLENE: CONCENTRATE
AT 150 F
INCONEL 750

* -- RINSED
+ -- UNRINSED

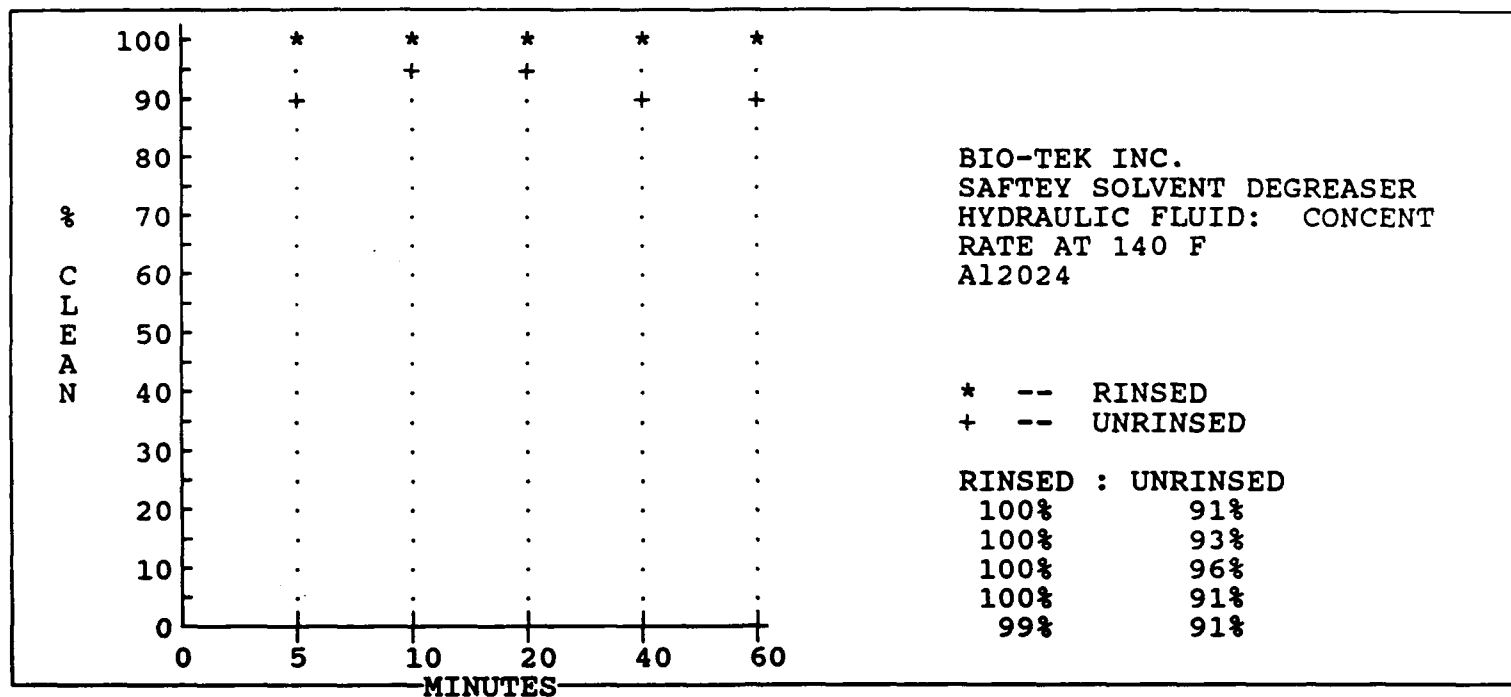
RINSED : UNRINSED	
100%	94%
99%	96%
98%	94%
98%	91%
100%	95%



BIO-TEK INC.
SAFTEY SOLVENT DEGREASER
GREASE: CONCENTRATE AT 140 F
Az31B

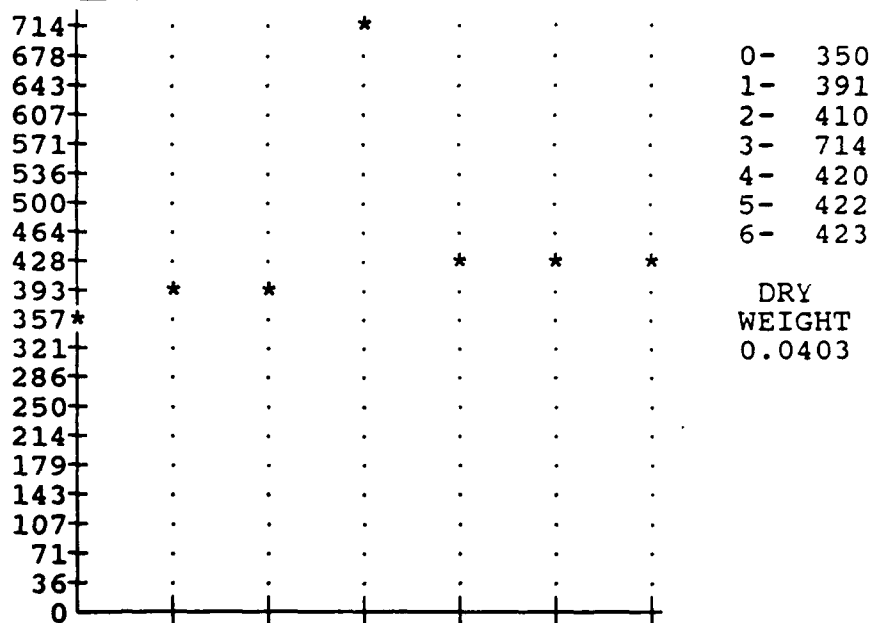
* -- RINSED
+ -- UNRINSED

RINSED : UNRINSED	
72%	68%
68%	67%
68%	67%
66%	68%
68%	67%



COMPANY - BRULIN
 PRODUCT - 711 SC
 TOC INIT- 39352
 TOC 2nd - 0
 COD INIT- 136000
 ANILINE PT - 0.0000
 ATP ----- 54 E-8

SOLUBILITY DATA:



DATE - 04/19/88 COD vs TIME 0 1 2 3 4 5 6

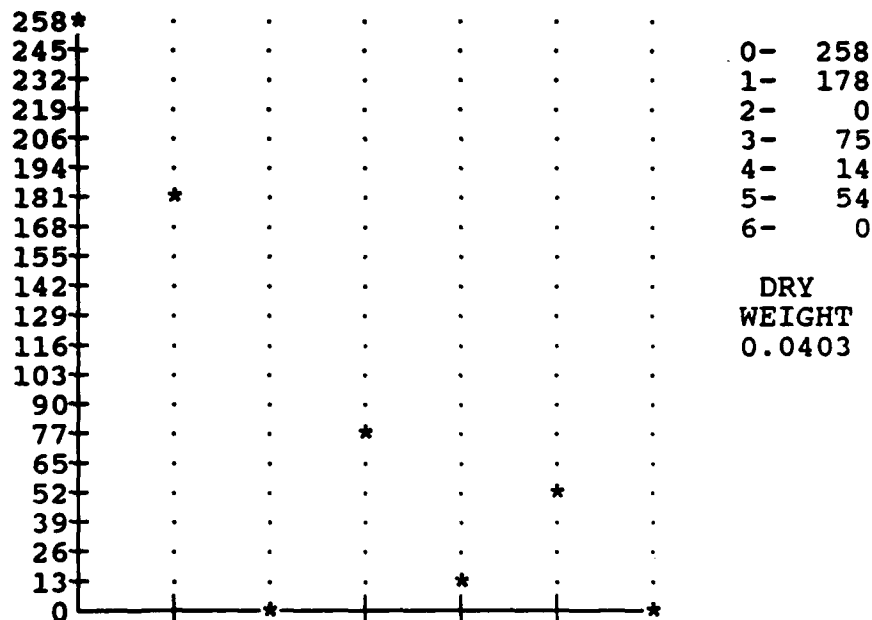
PHENOL
 04/19/88
 ATP - 0 E-8

BRULIN
 711 SC

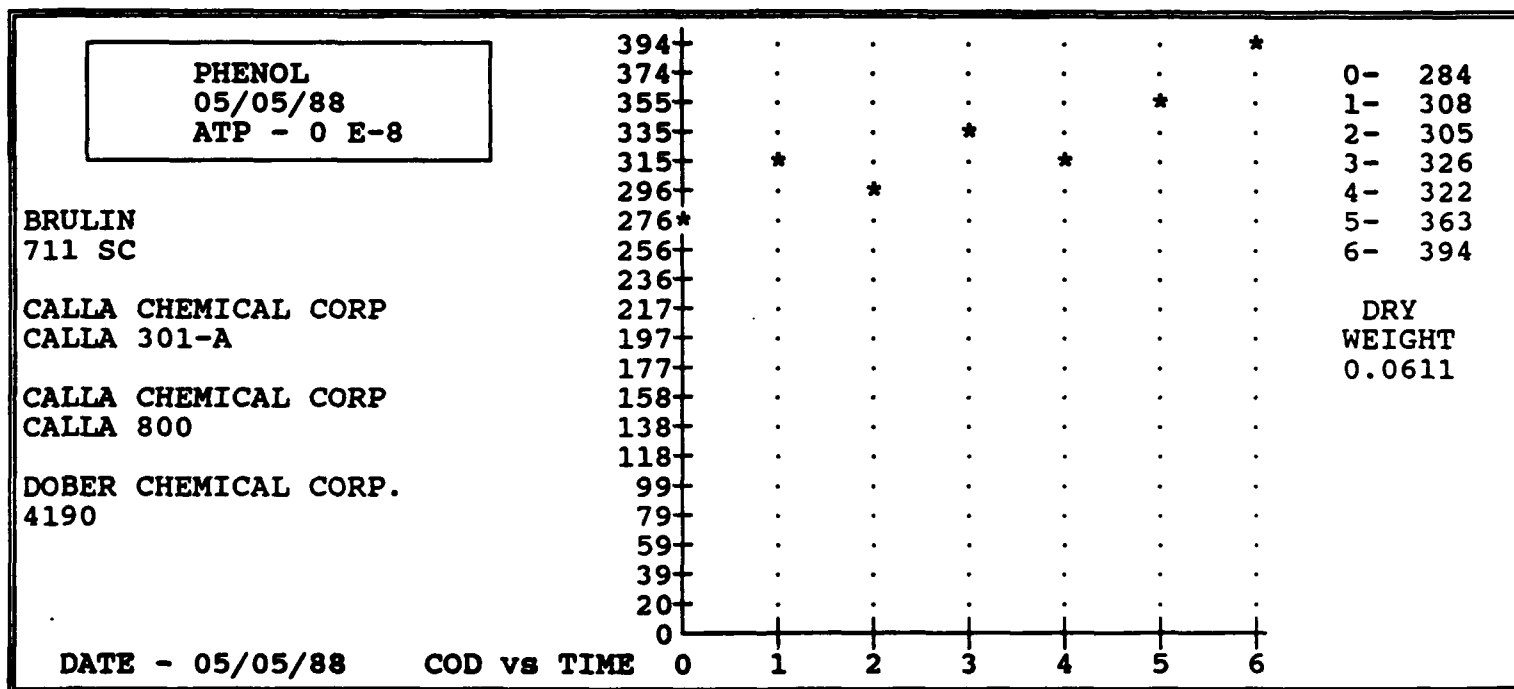
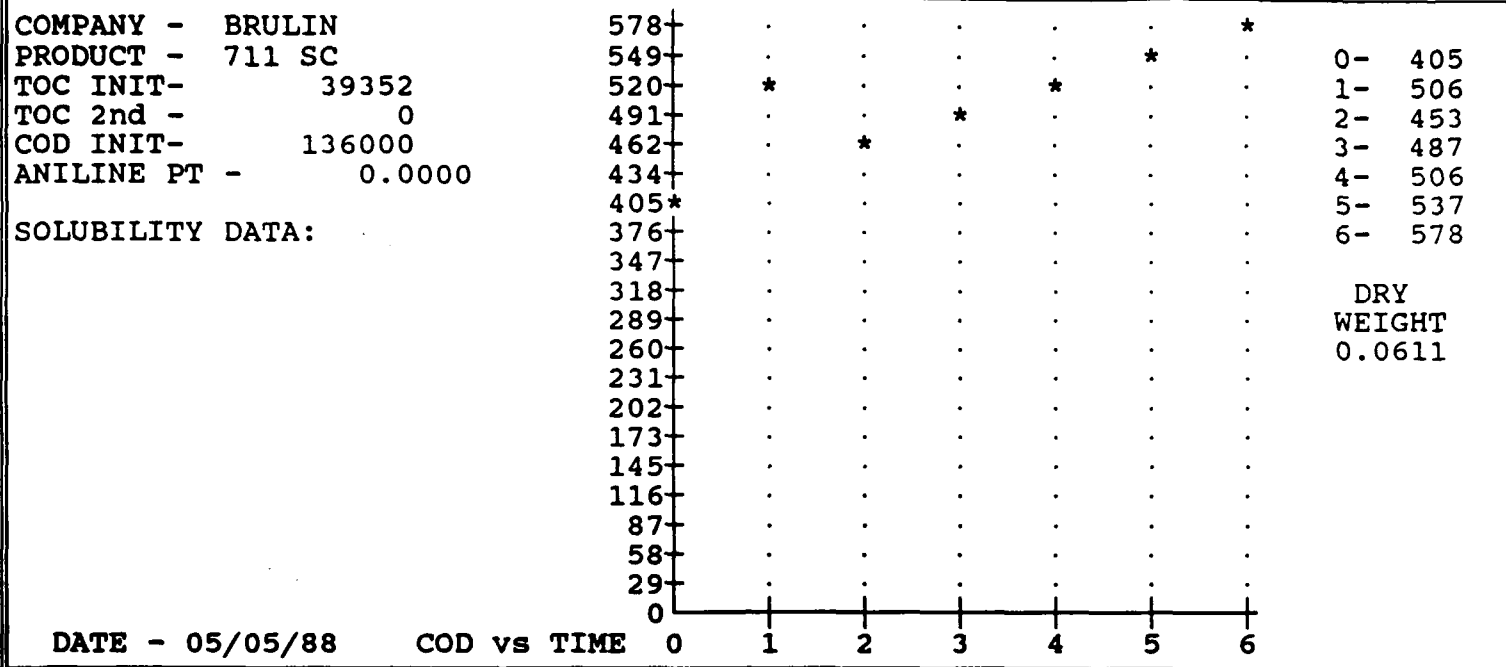
CALLA CHEMICAL CORP
 CALLA 301-A

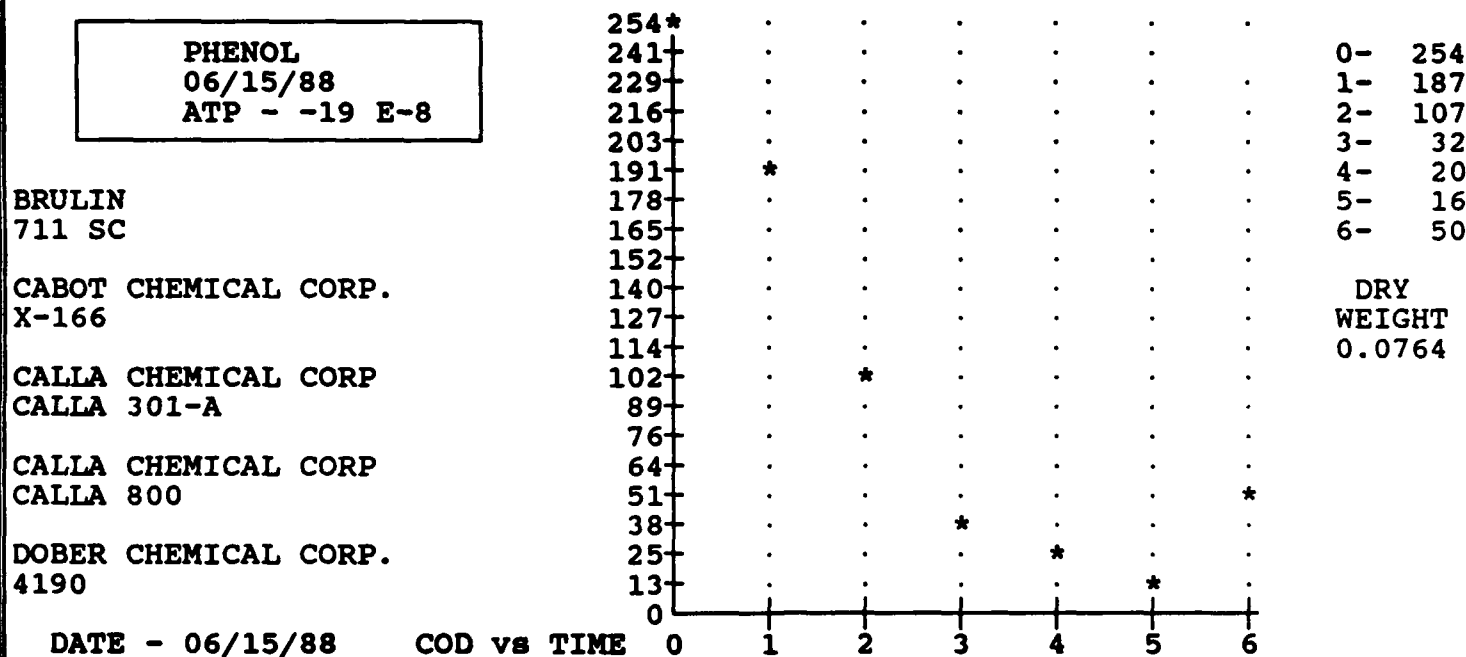
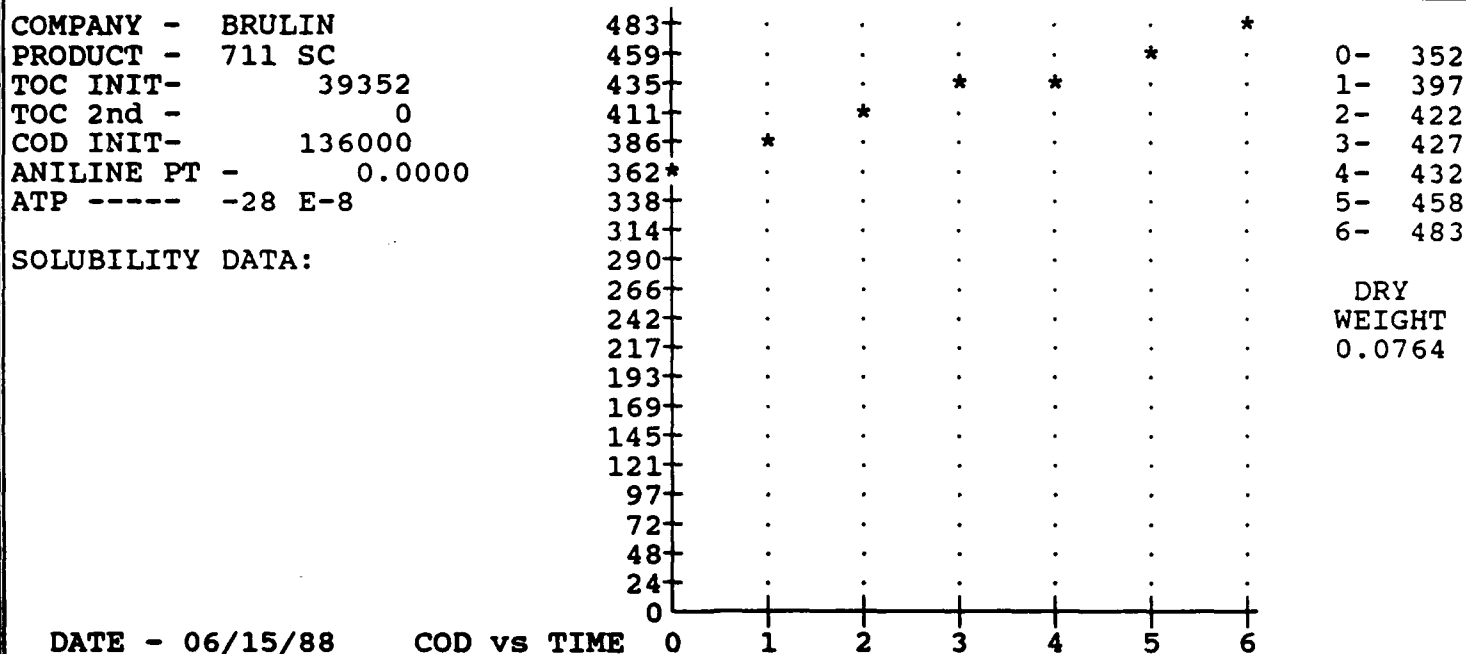
CALLA CHEMICAL CORP
 CALLA 800

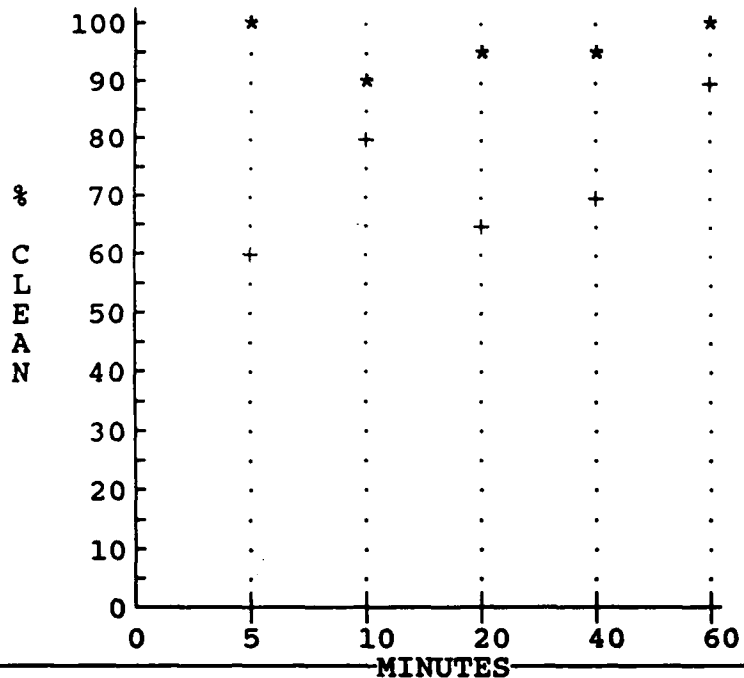
DOBER CHEMICAL CORP.
 4190



DATE - 04/19/88 COD vs TIME 0 1 2 3 4 5 6



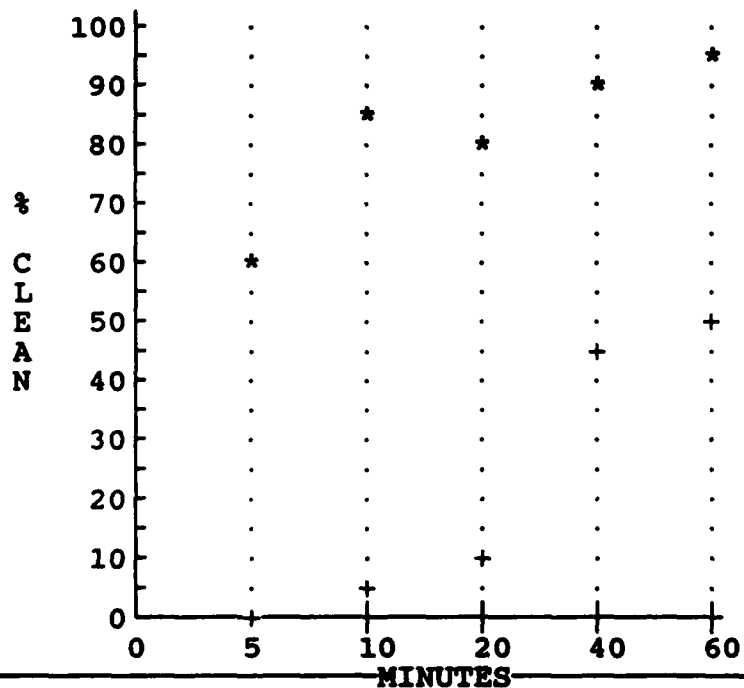




BRULIN
711 SC
GREASE: 1:3 AT AMBIENT
MONEL K-500

* -- RINSED
+ -- UNRINSED

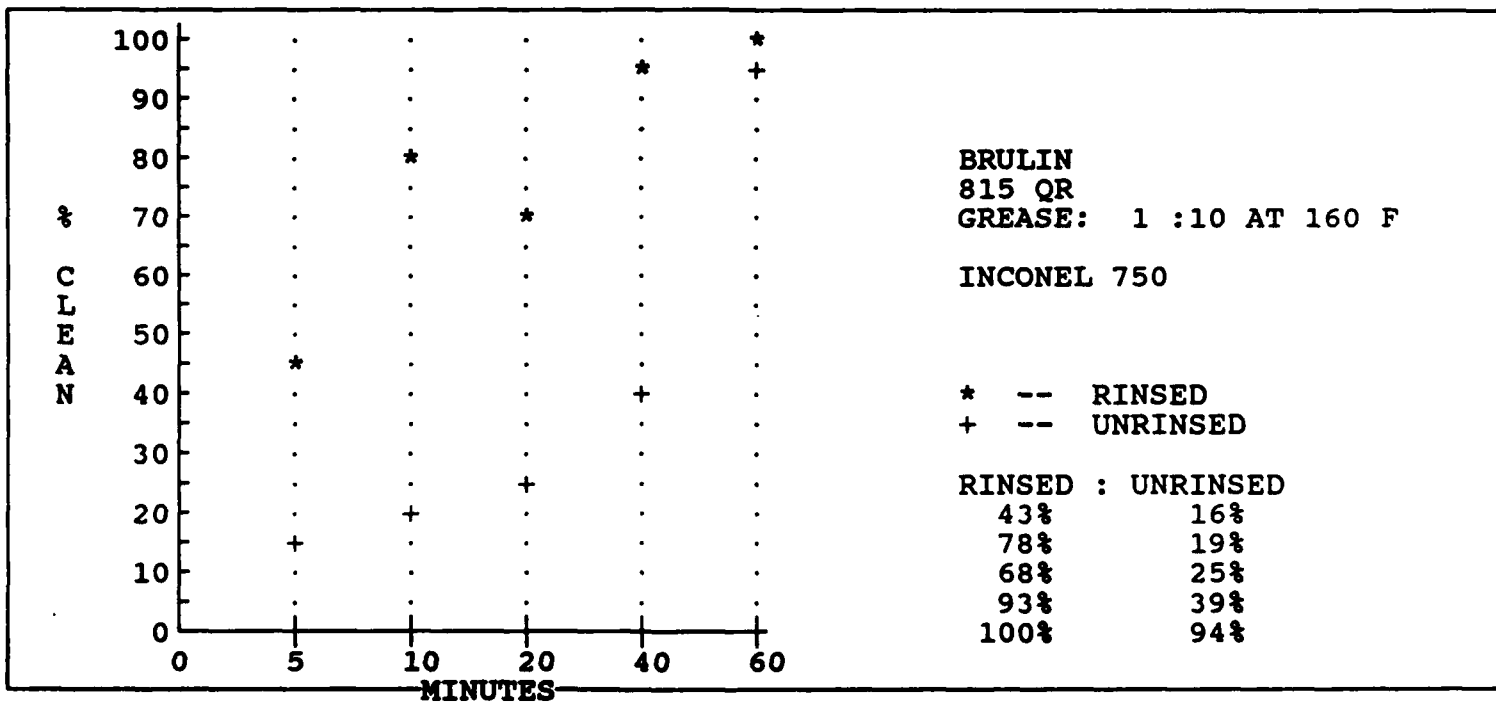
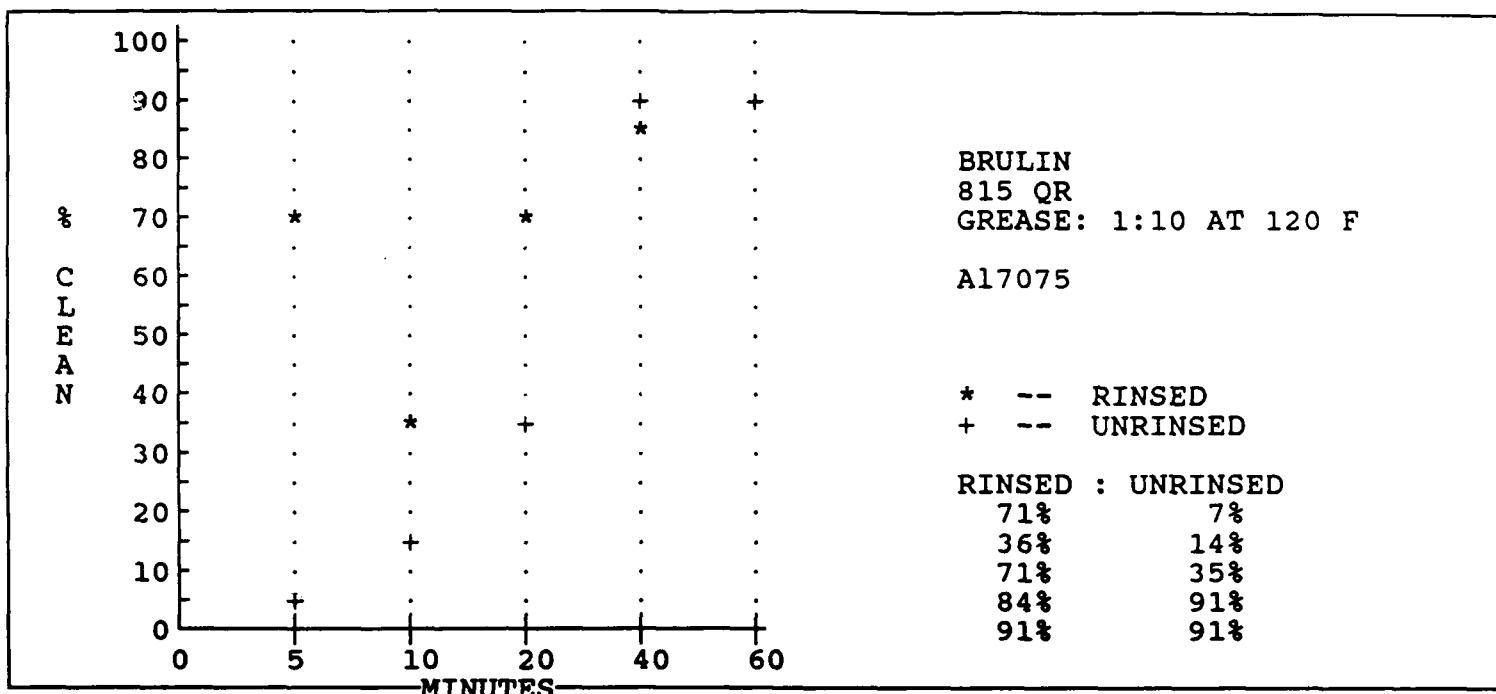
RINSED : UNRINSED	
98%	58%
92%	80%
93%	67%
95%	68%
99%	88%

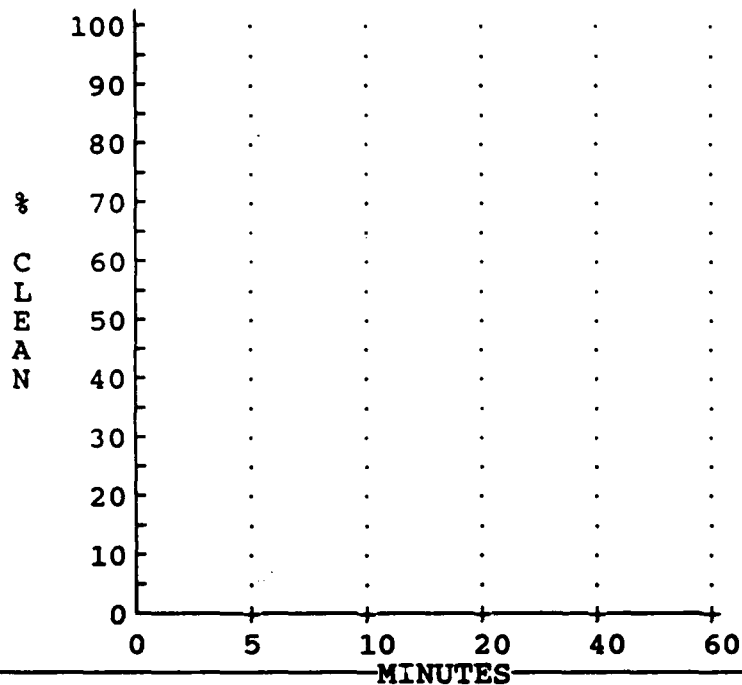


BRULIN
711 SC
HYDRAULIC FLUID: 1:3 AT
AMBIENT
C1020

* -- RINSED
+ -- UNRINSED

RINSED : UNRINSED	
62%	0%
88%	4%
80%	8%
92%	44%
97%	50%

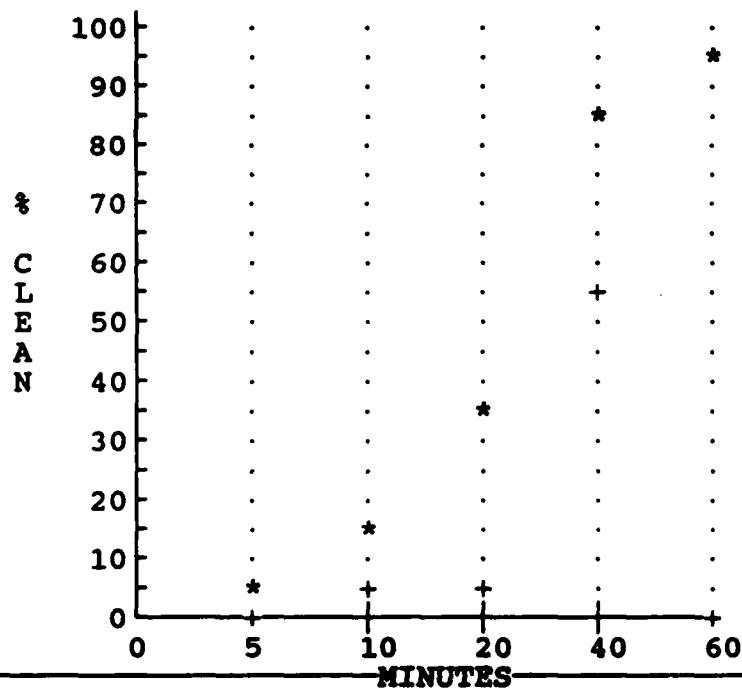




BRULIN
815 QR
OIL & XYLENE: 1:20 AT 160
F
MONEL K-500

* -- RINSED
+ -- UNRINSED

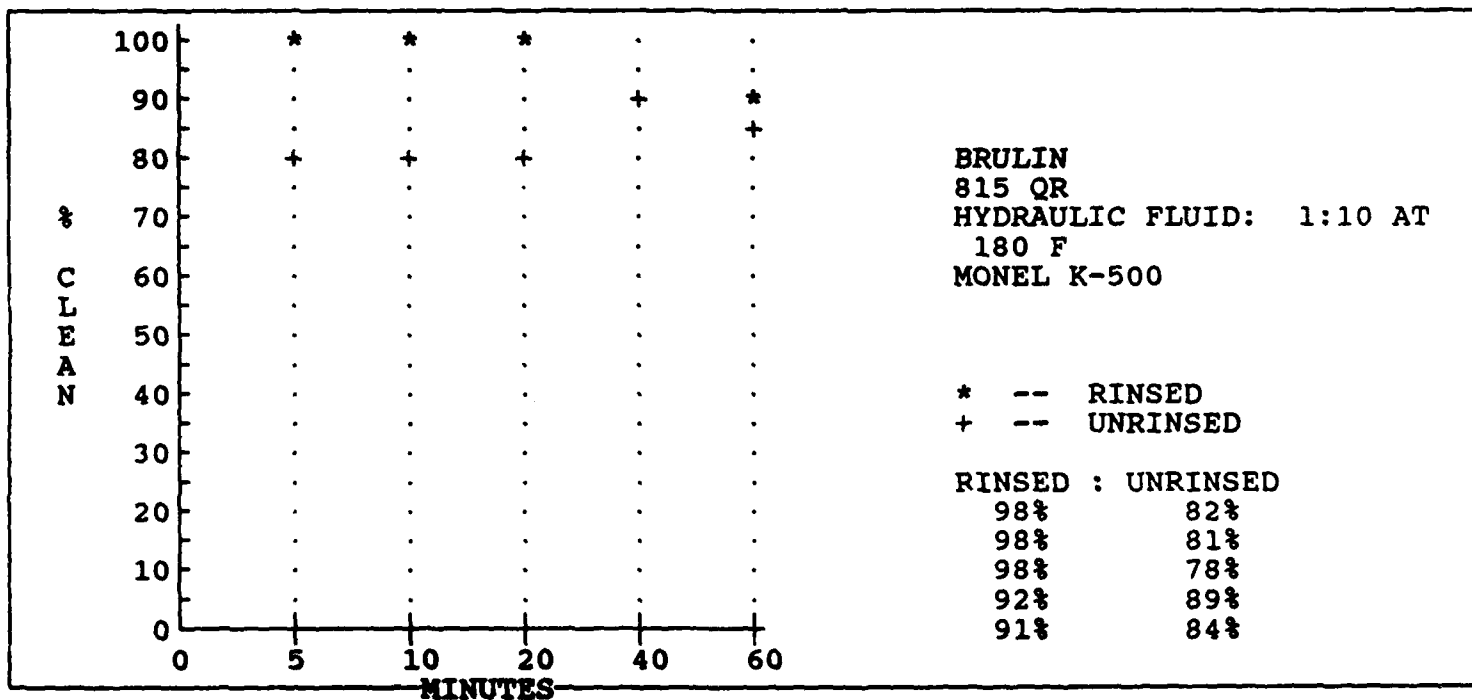
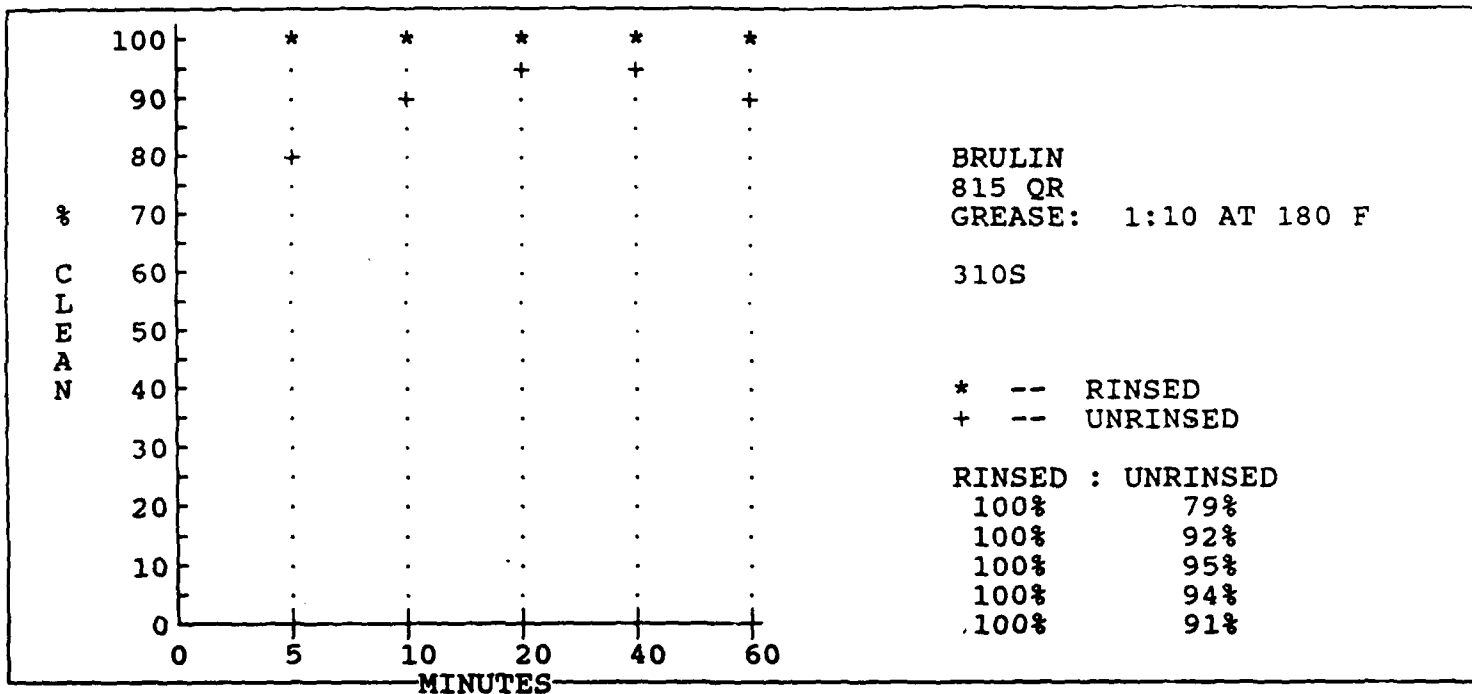
RINSED : UNRINSED	
0%	0%
0%	0%
0%	0%
0%	0%
0%	0%

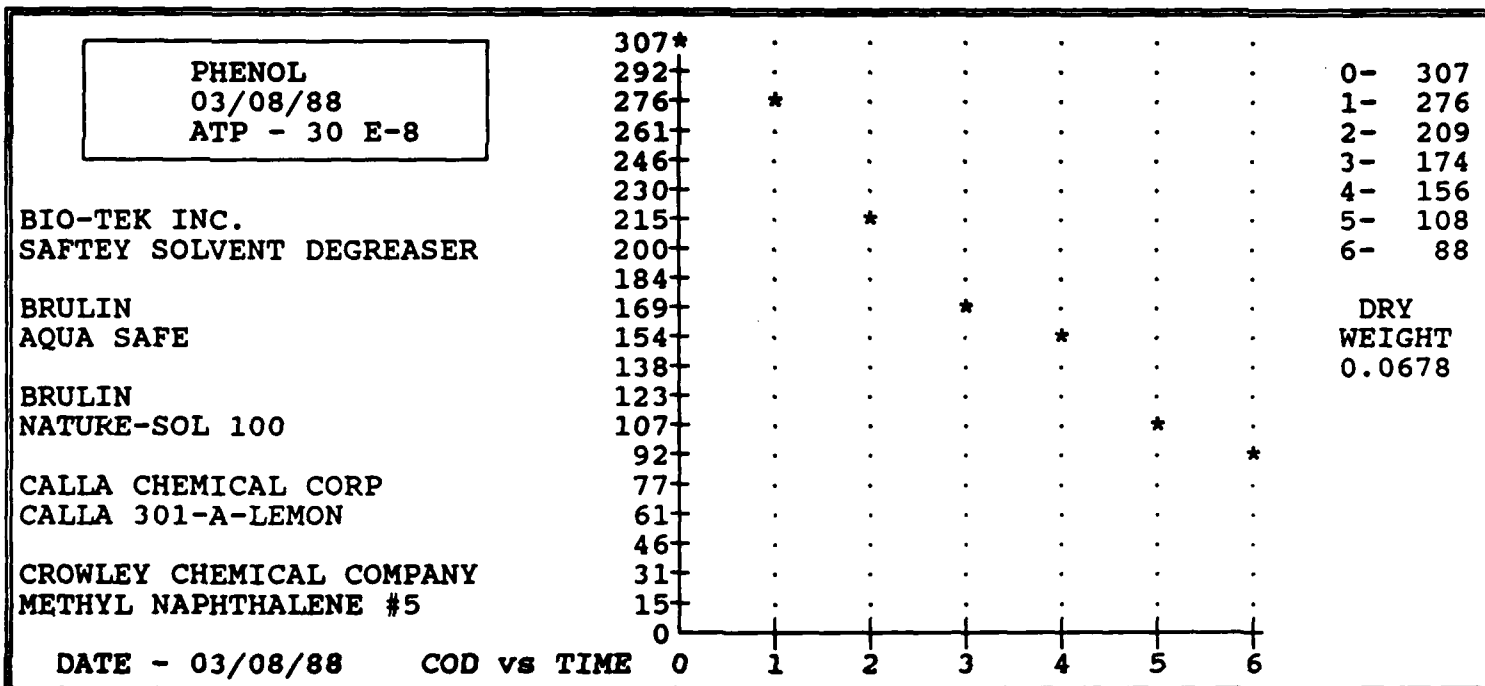
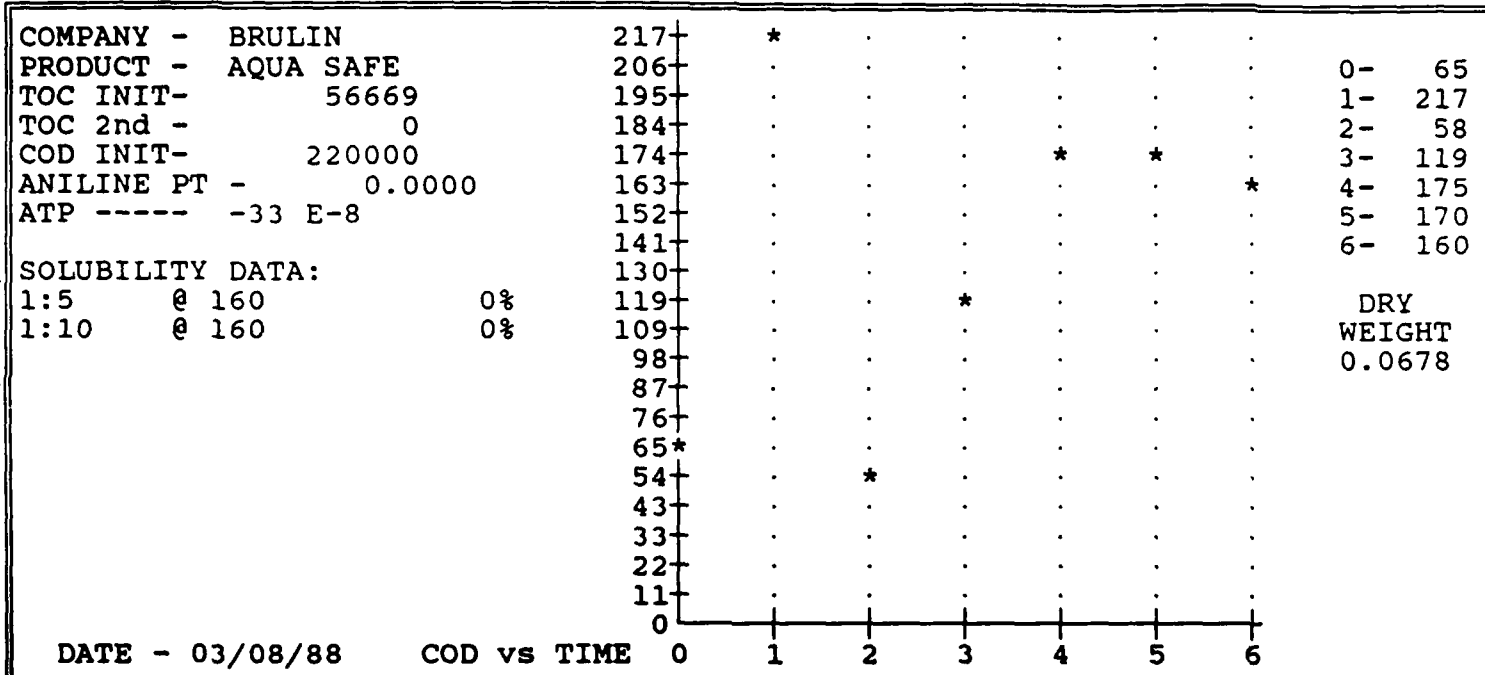


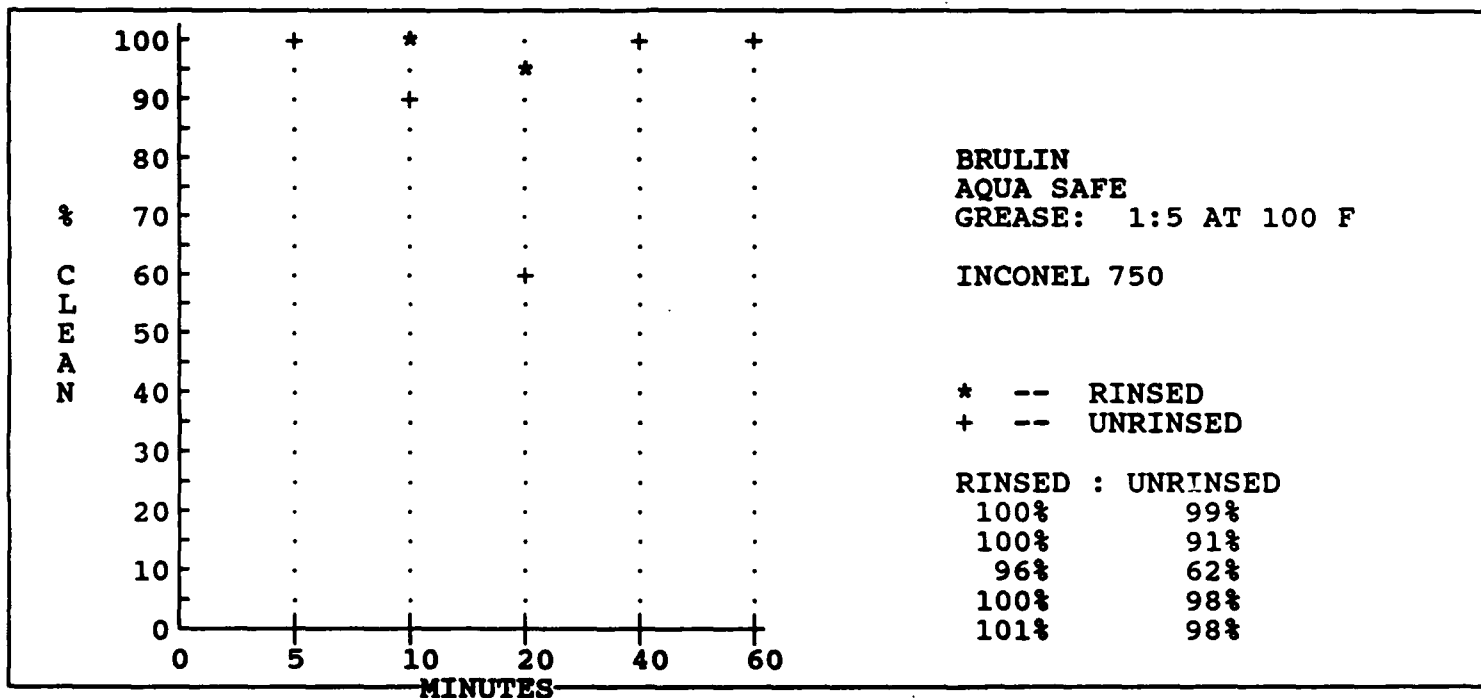
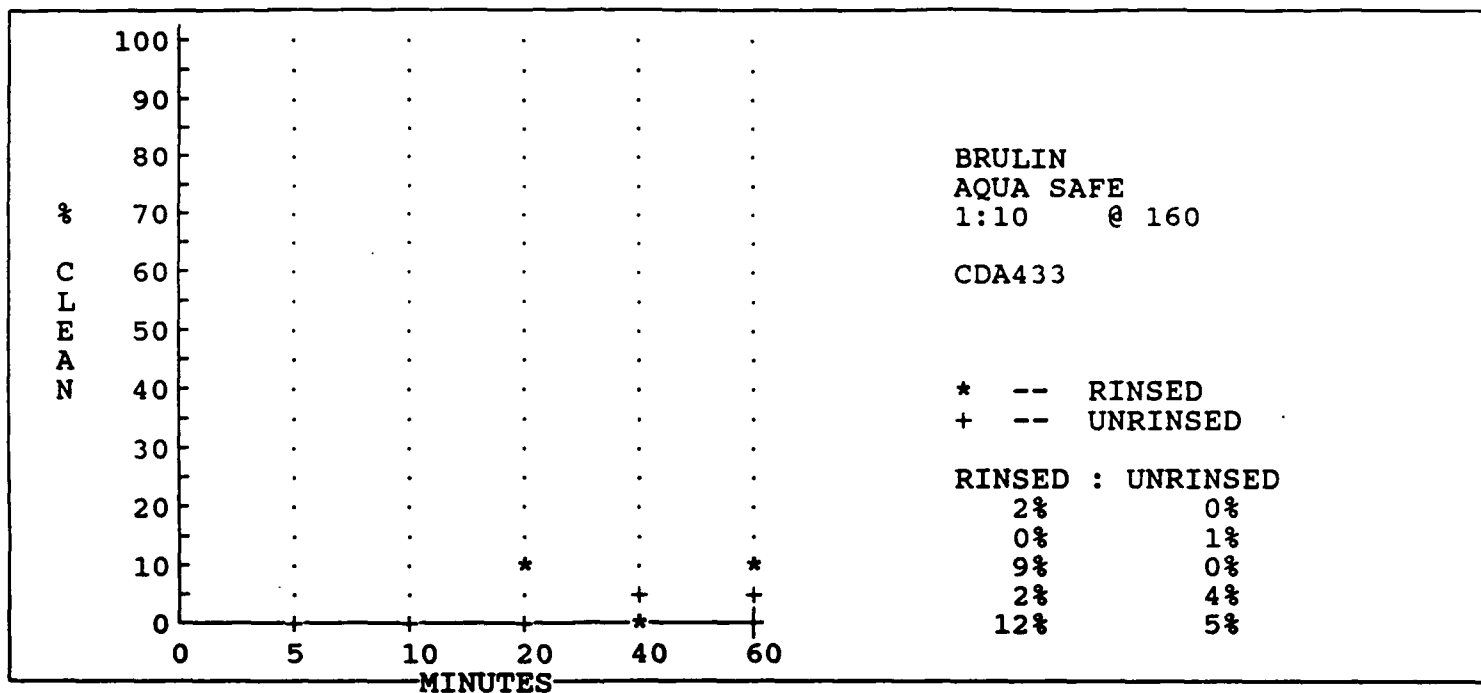
BRULIN
815 QR
OIL/XYLENE: 1:10 AT 200
F
Az31B

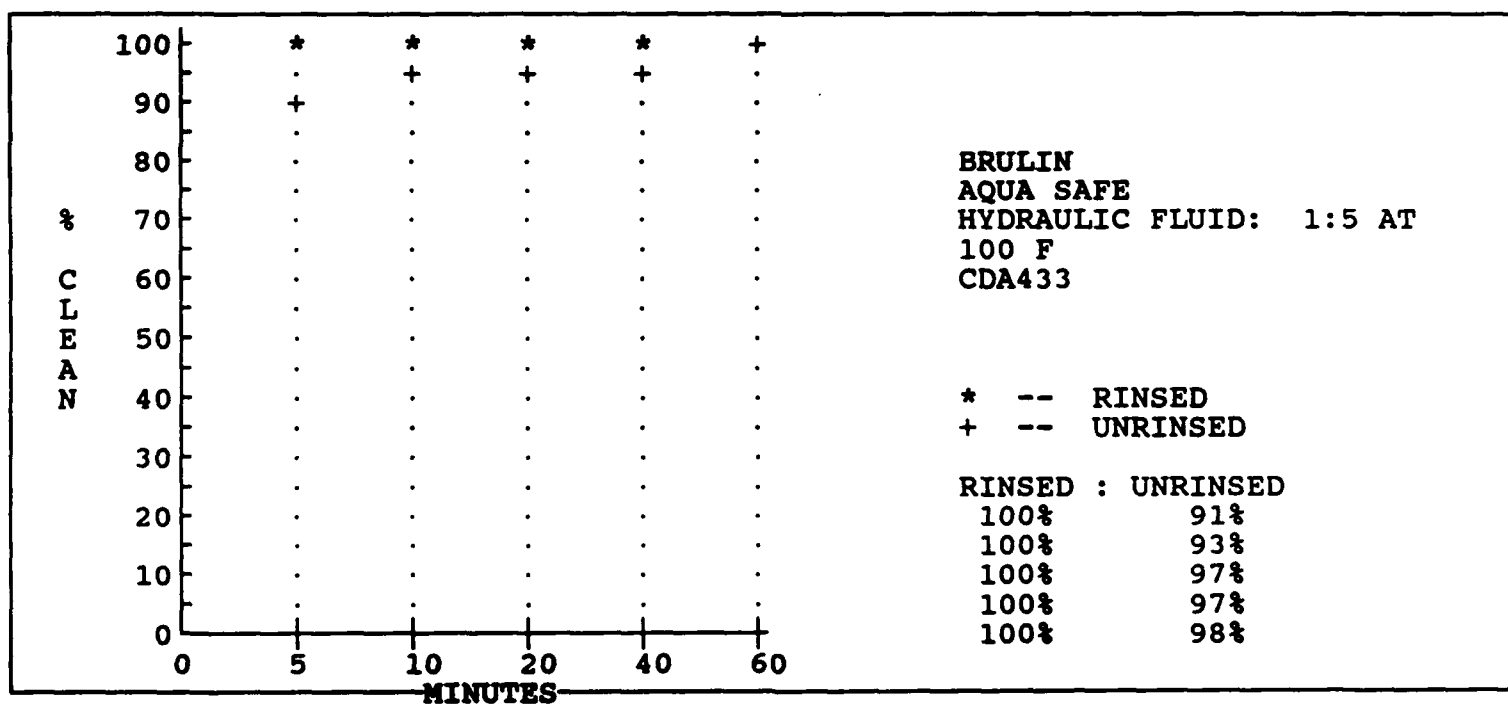
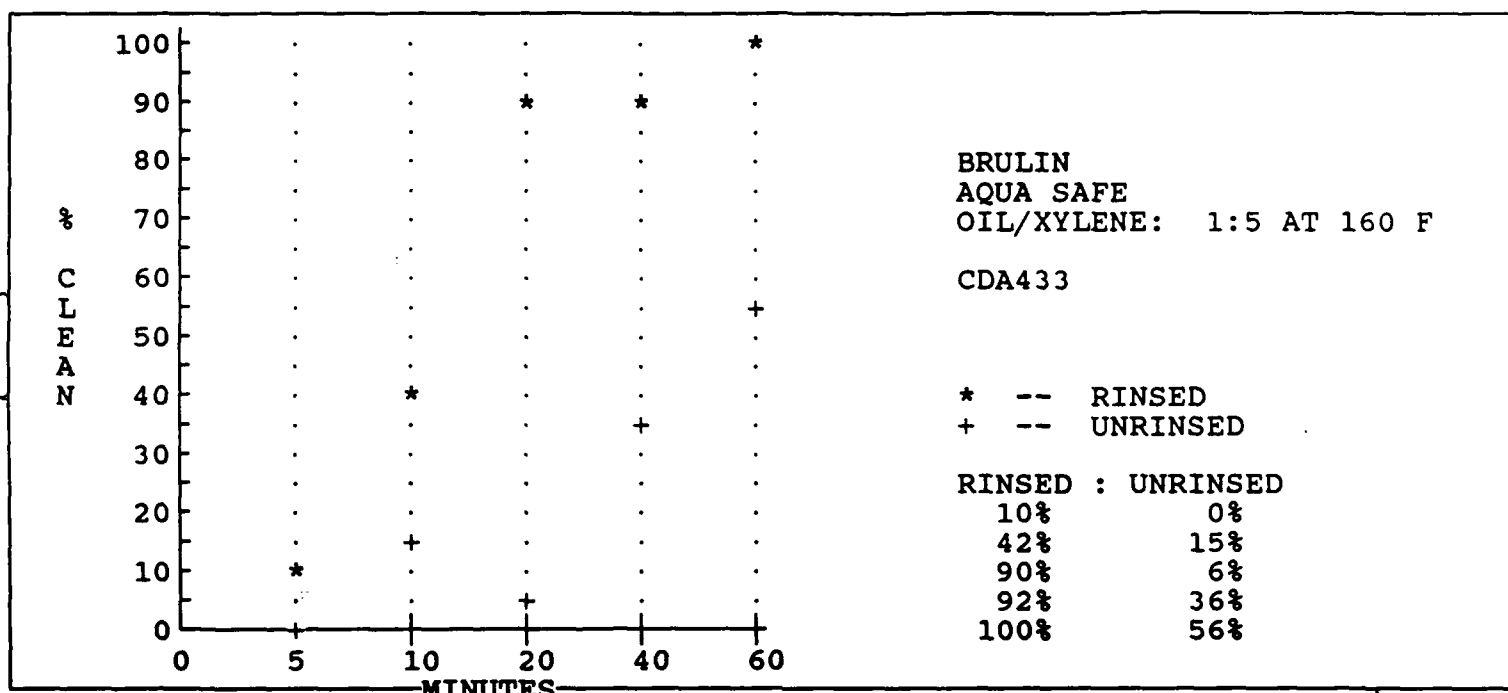
* -- RINSED
+ -- UNRINSED

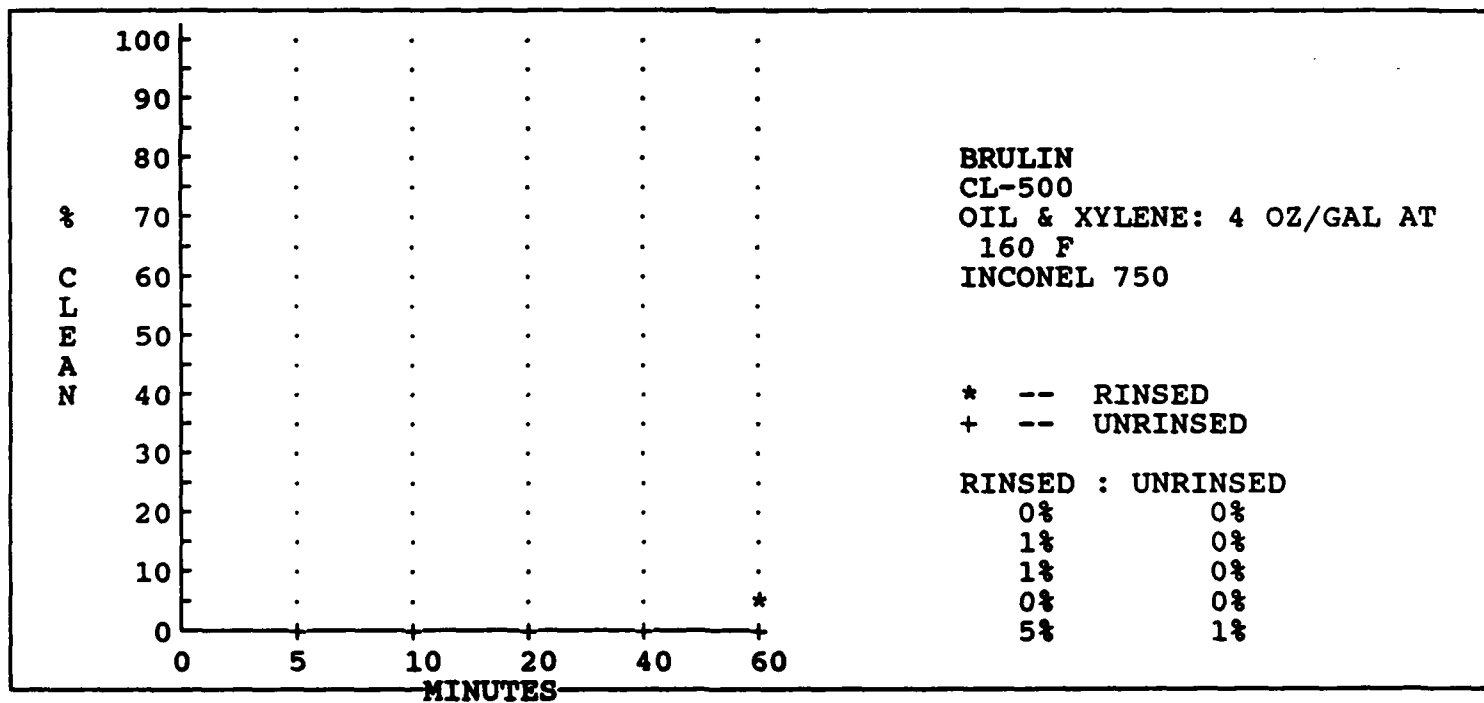
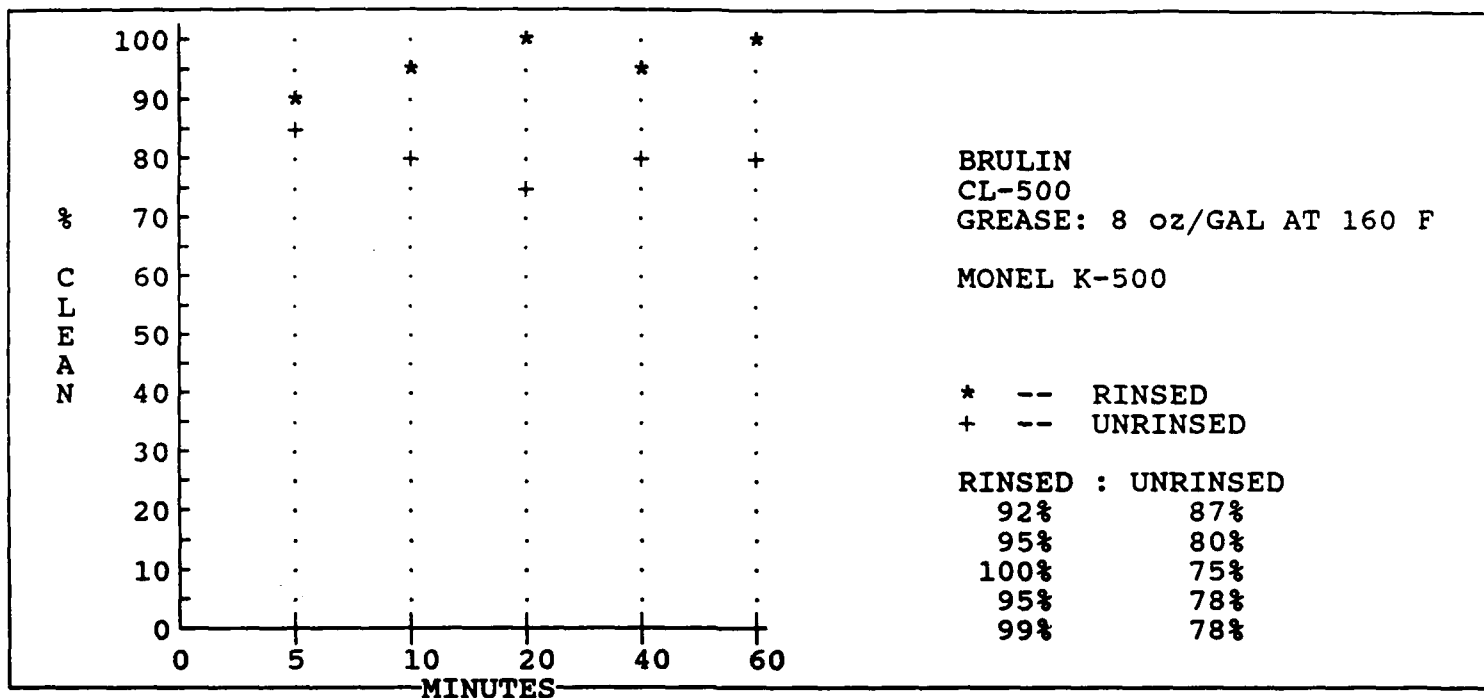
RINSED : UNRINSED	
3%	1%
16%	7%
35%	7%
84%	56%
94%	0%

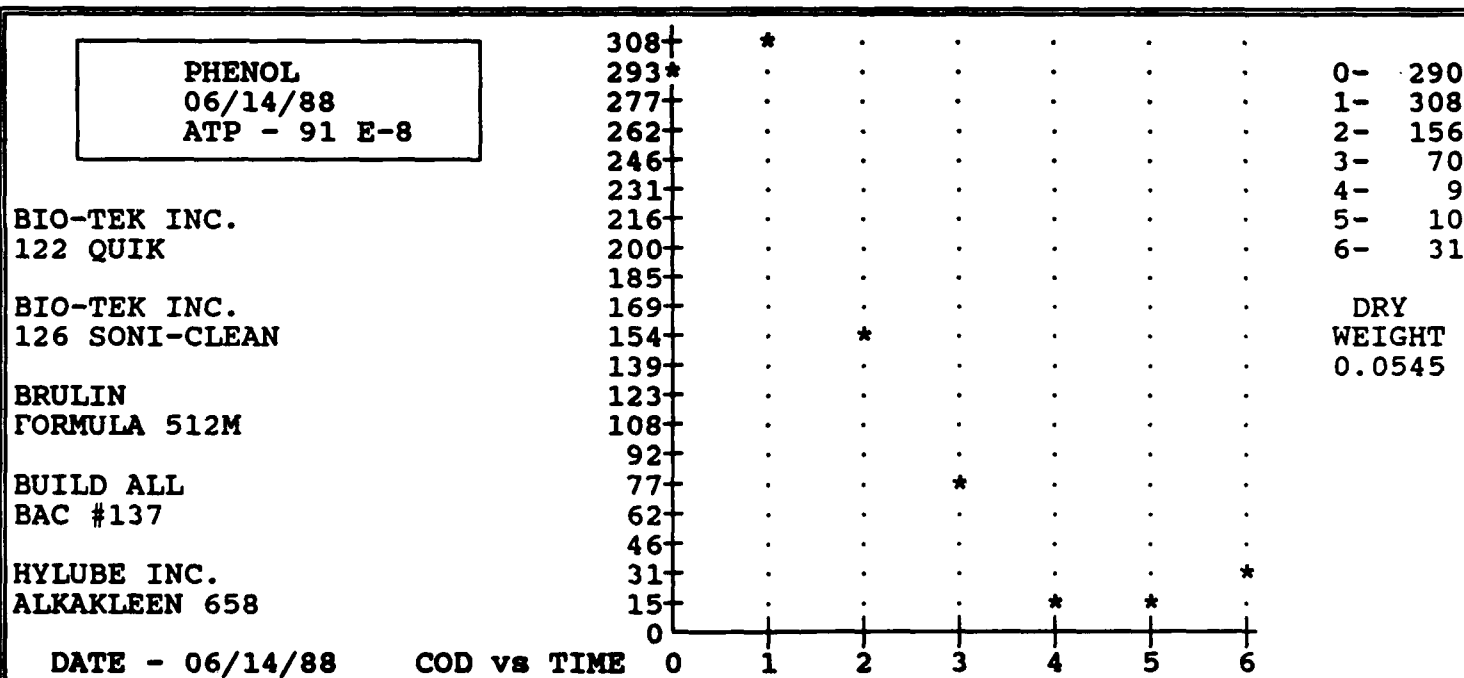
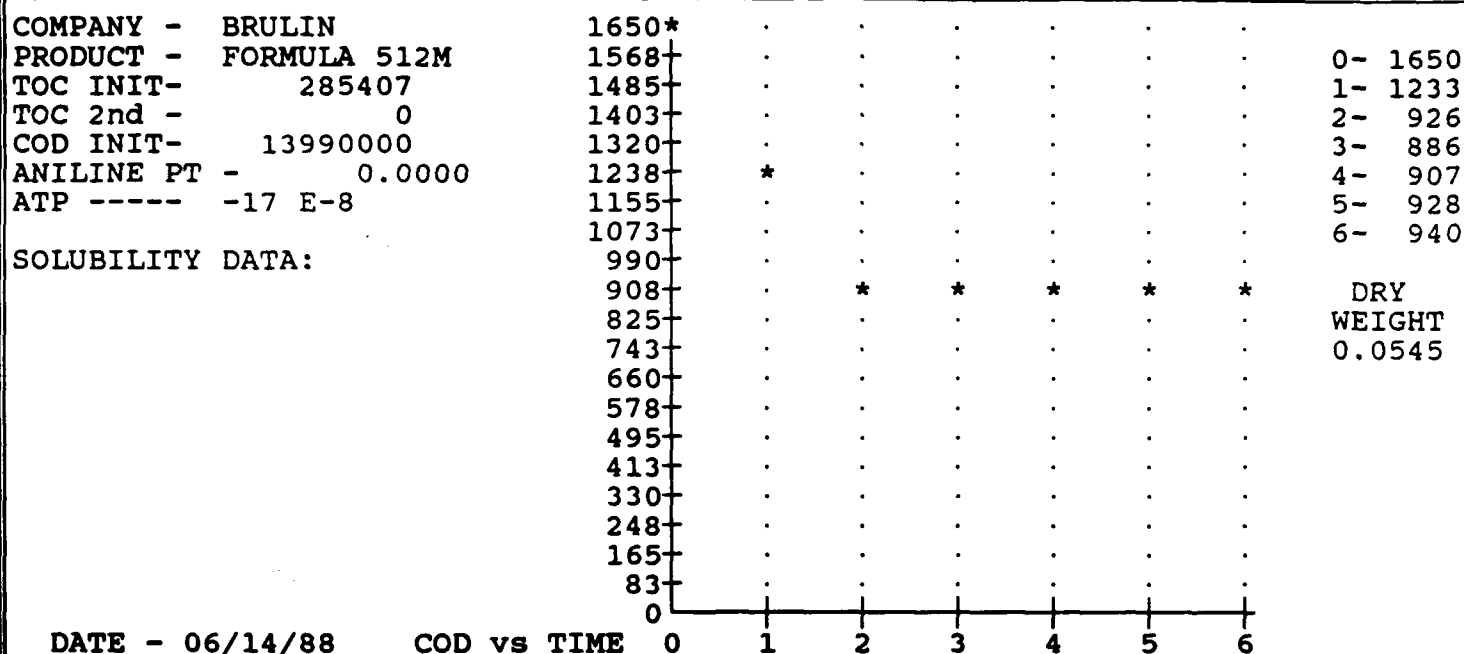


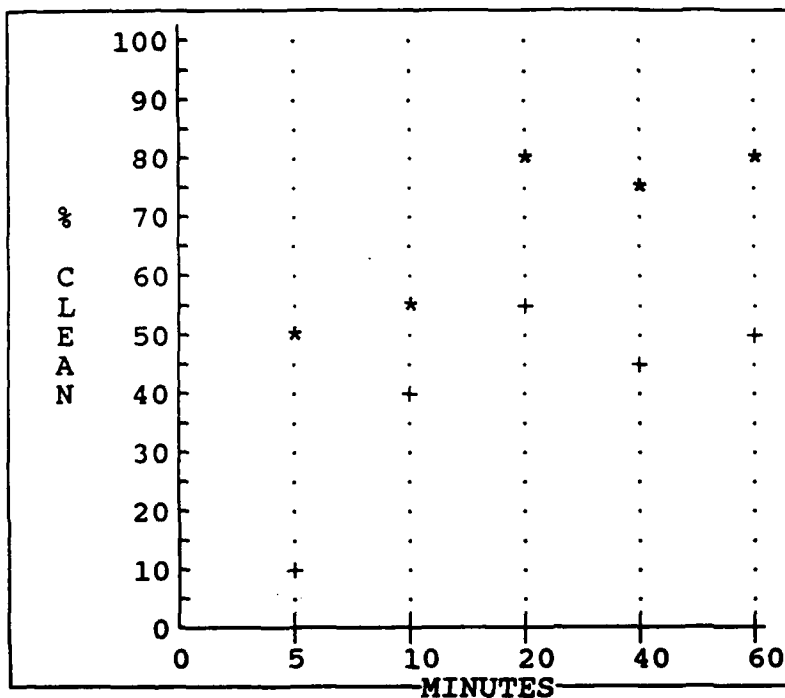












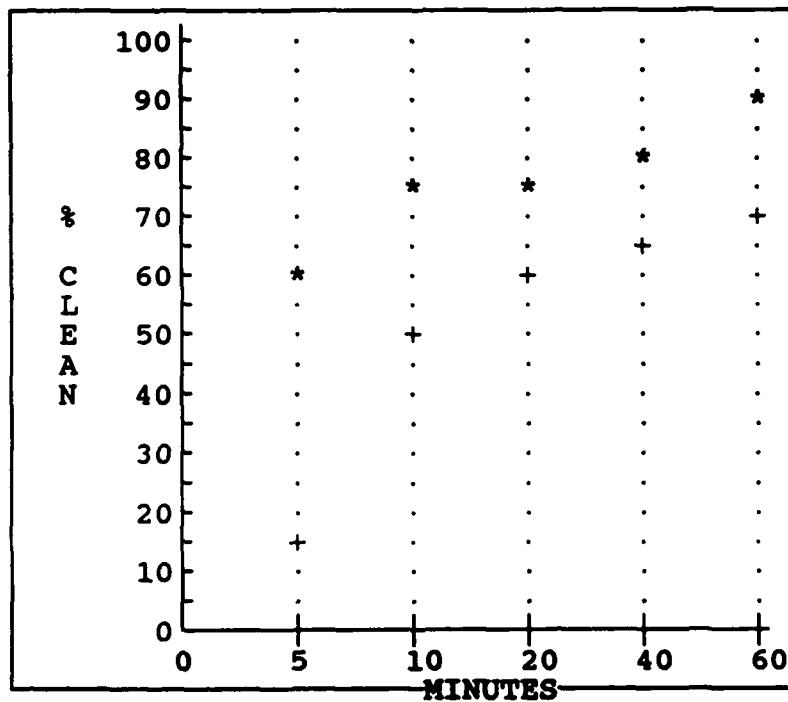
BRULIN
FORMULA 512M
GREASE: 1:4 AT AMBIENT

MONEL K-500

* -- RINSED
+ -- UNRINSED

RINSED : UNRINSED

51%	11%
56%	39%
81%	56%
76%	45%
82%	50%



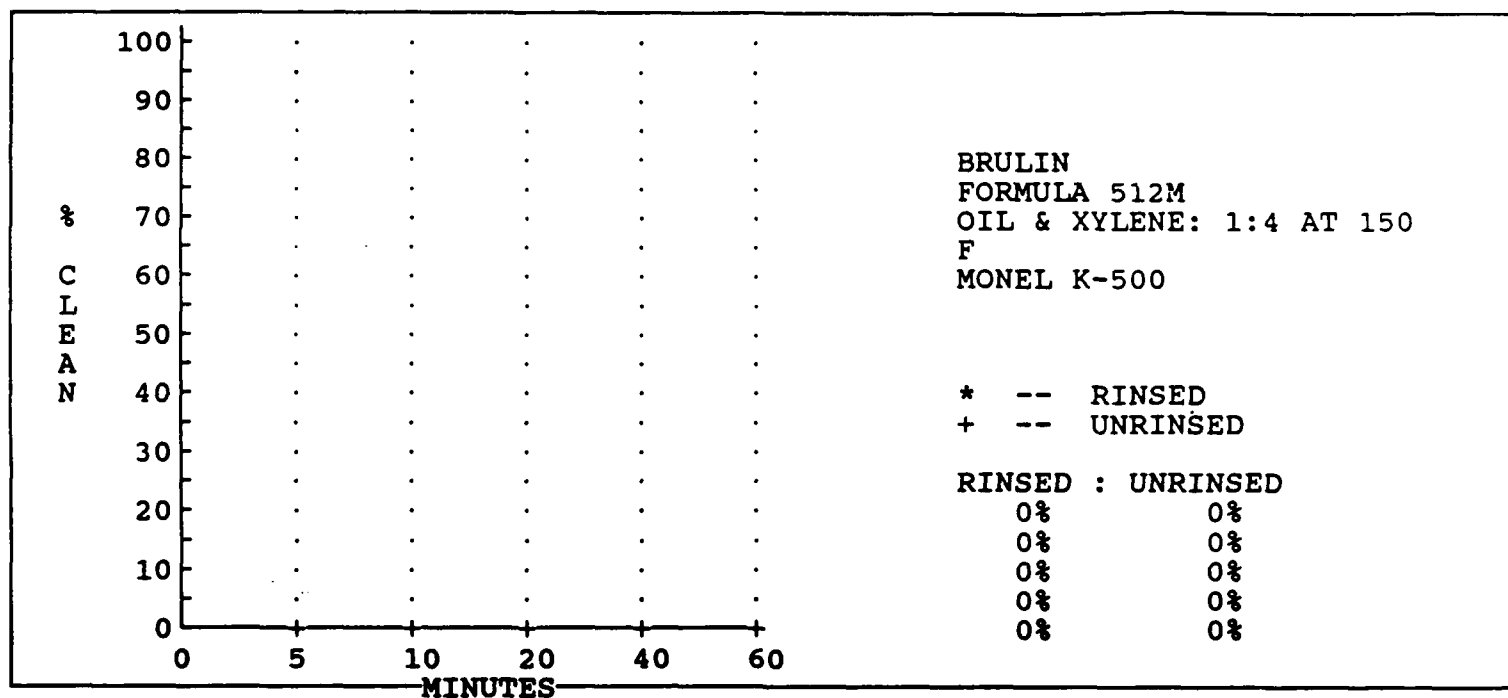
BRULIN
FORMULA 512M
GREASE: 1:4 AT 150 F

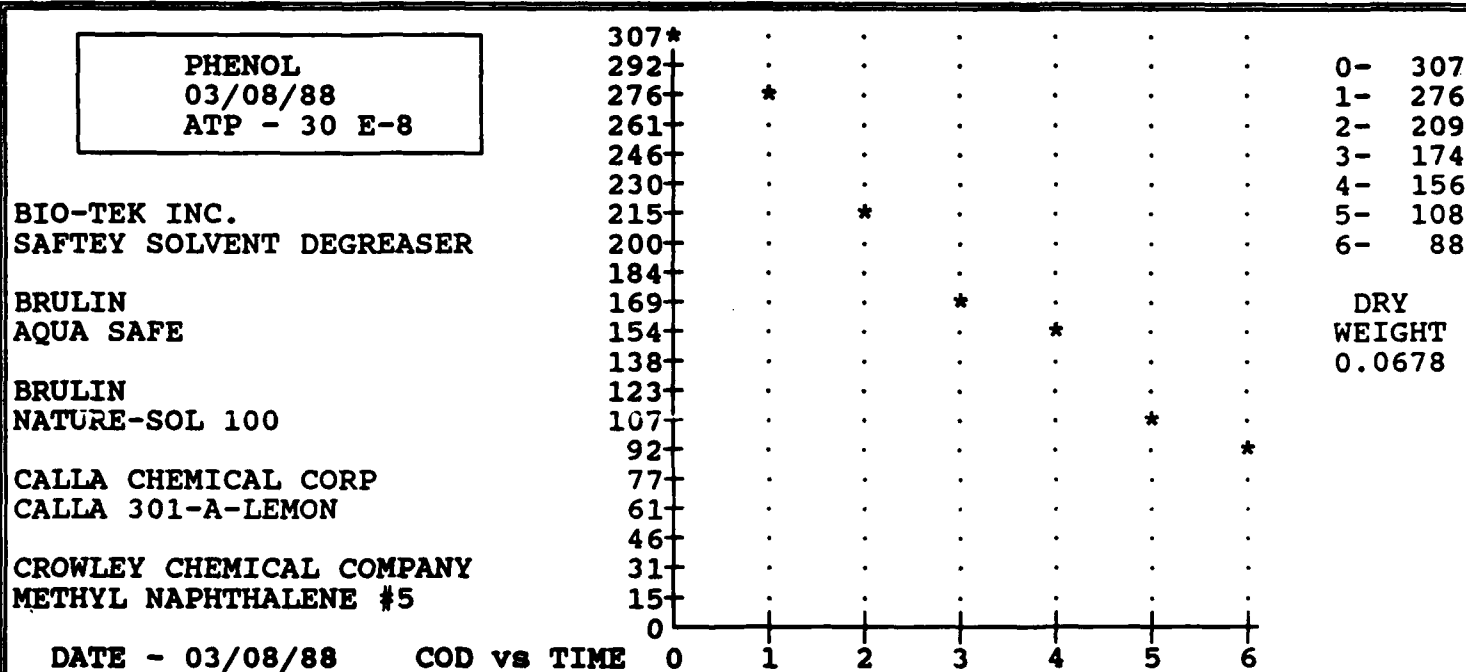
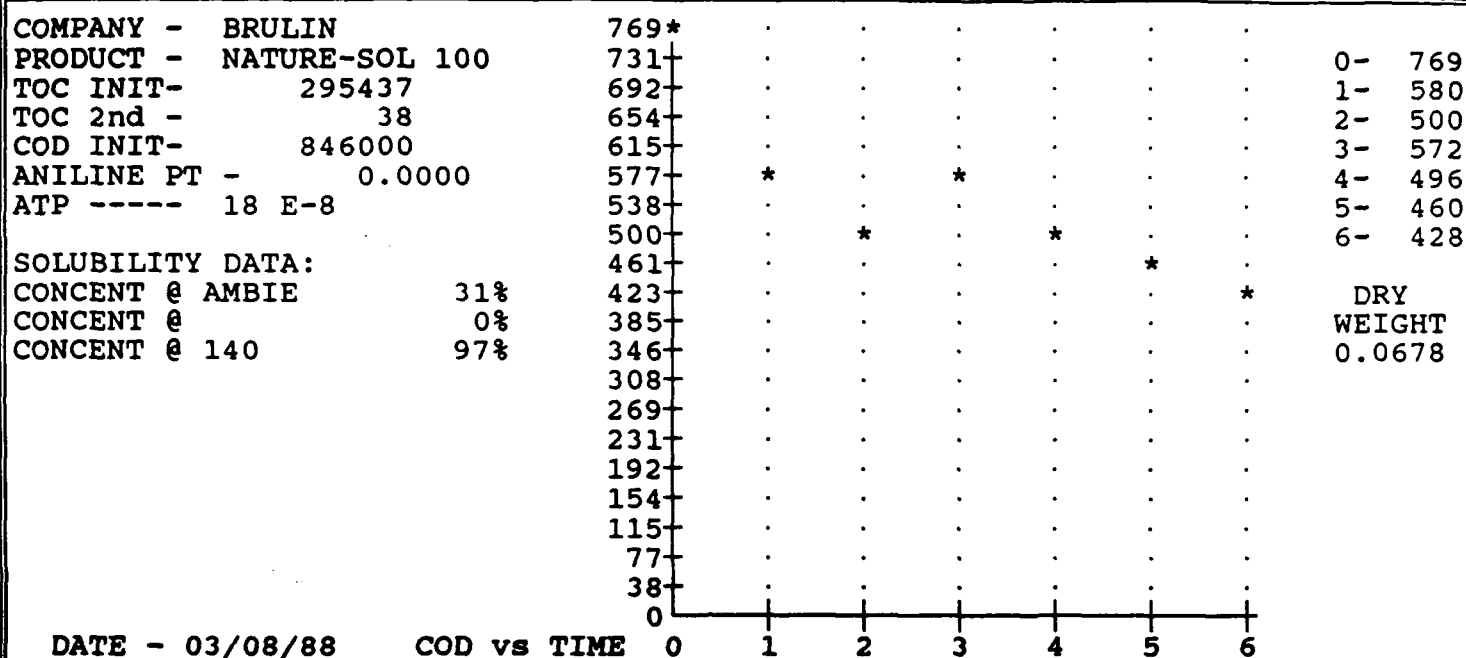
MONEL K-500

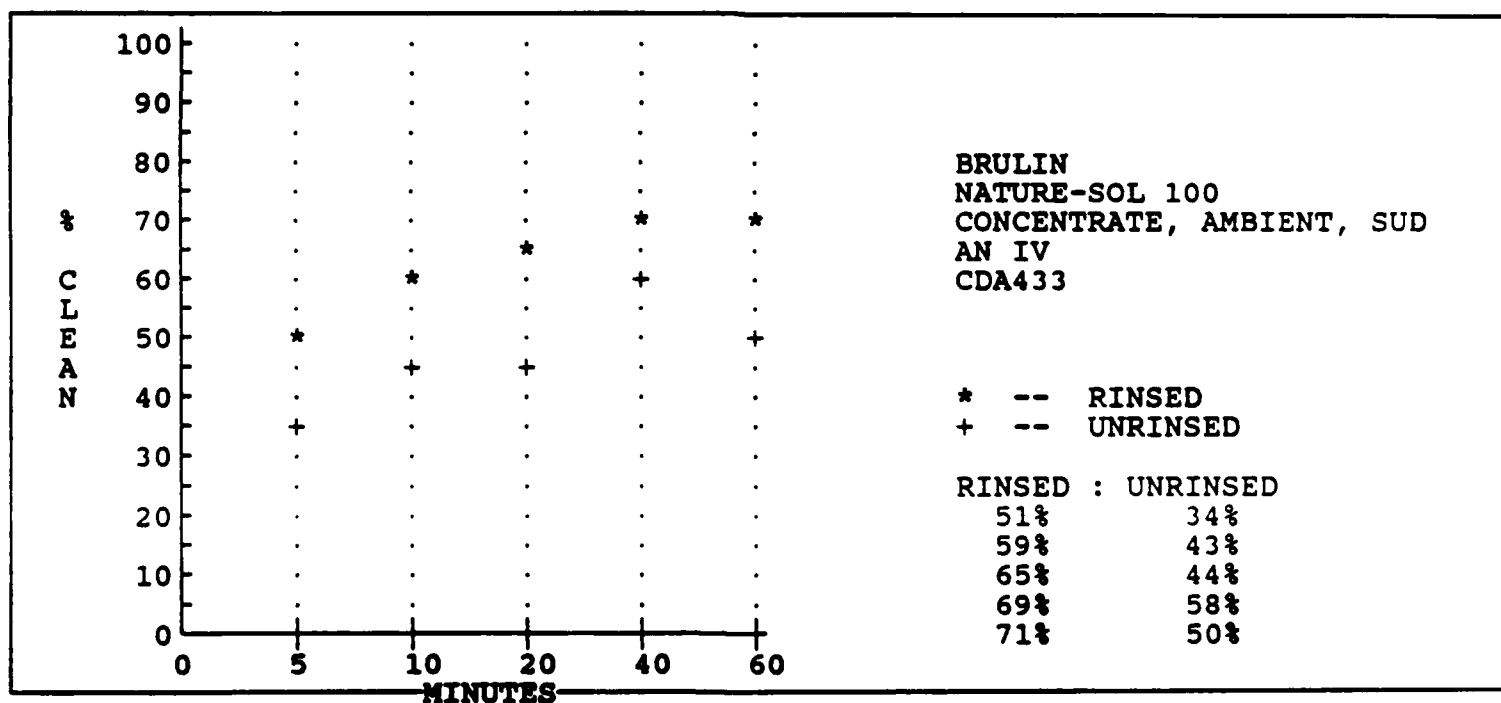
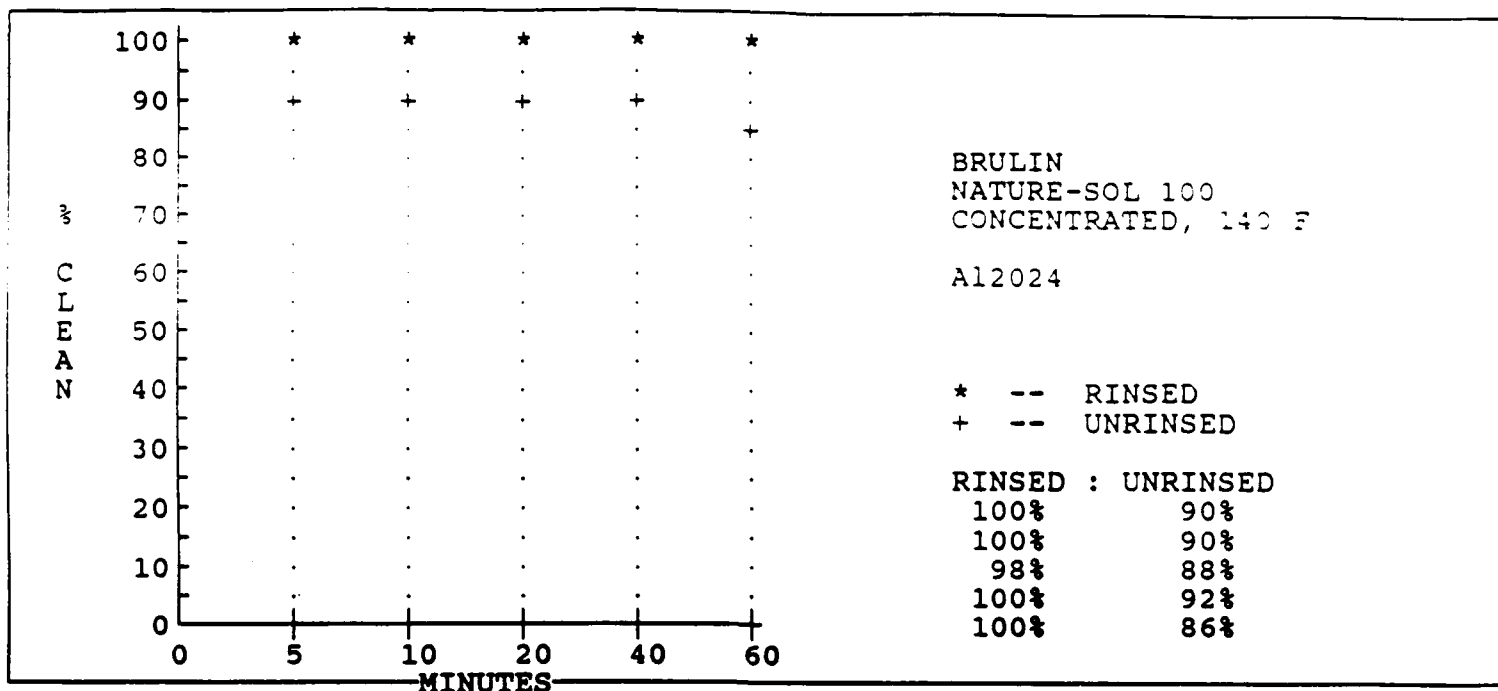
* -- RINSED
+ -- UNRINSED

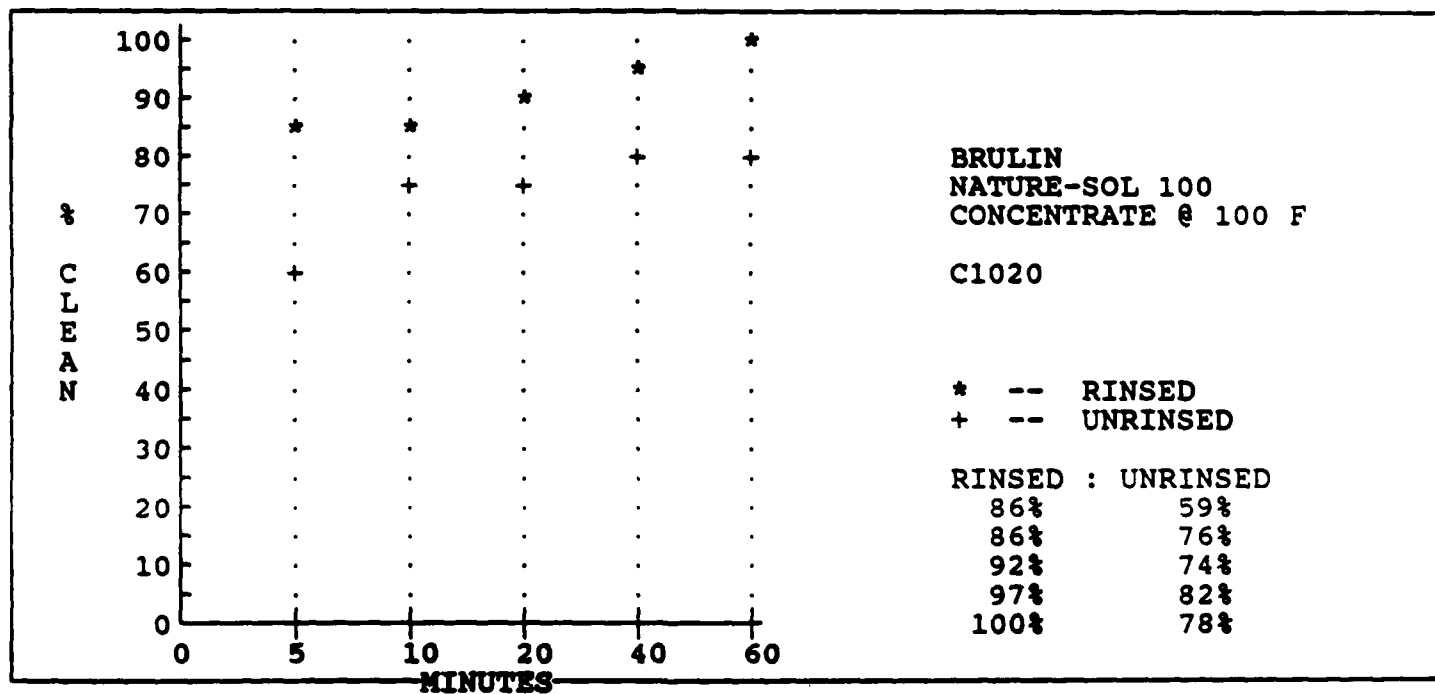
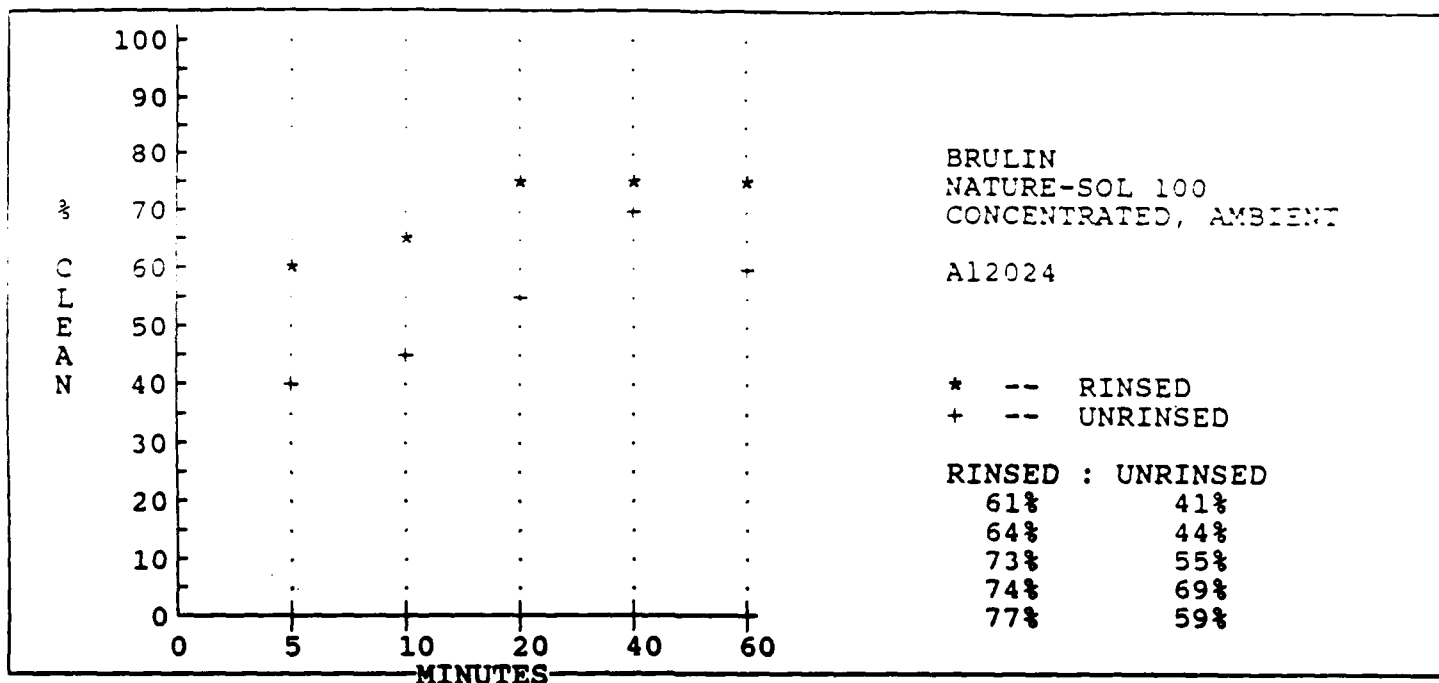
RINSED : UNRINSED

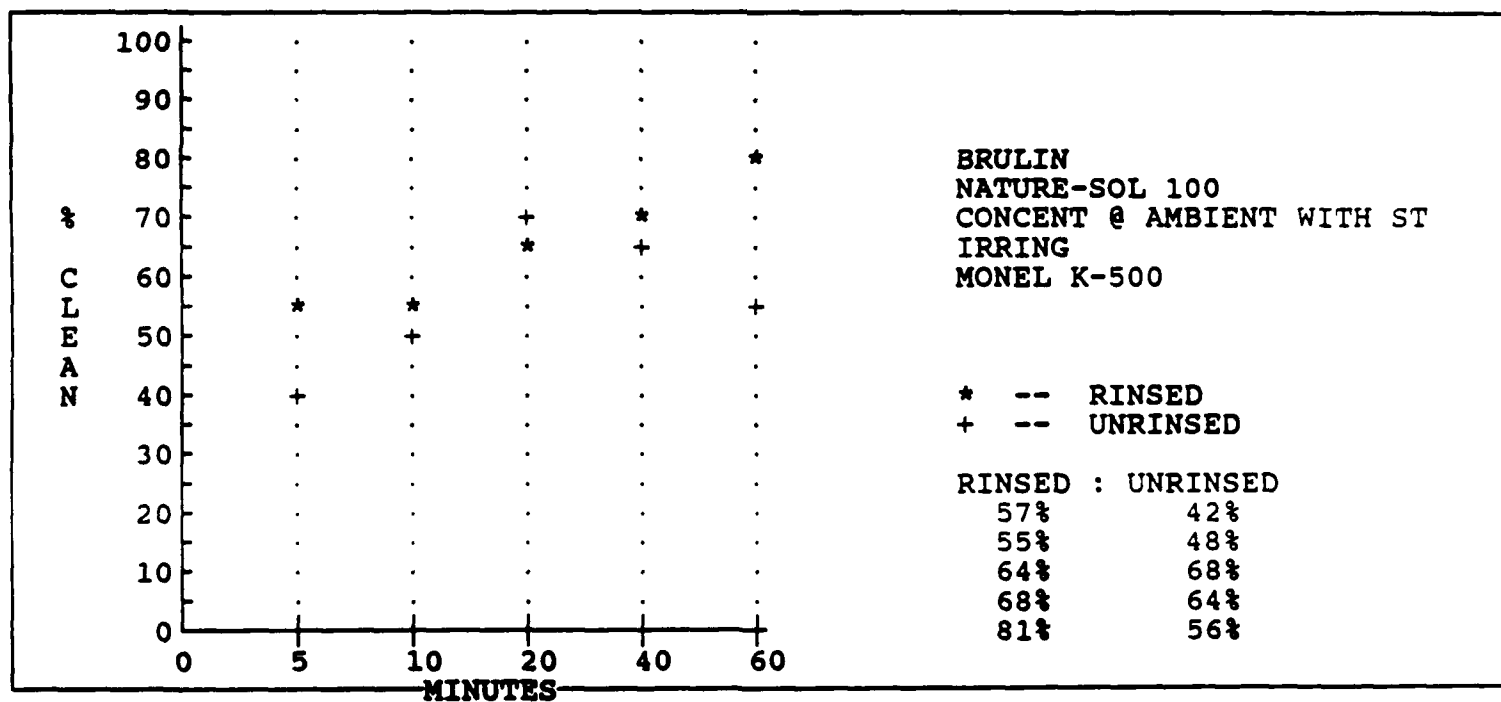
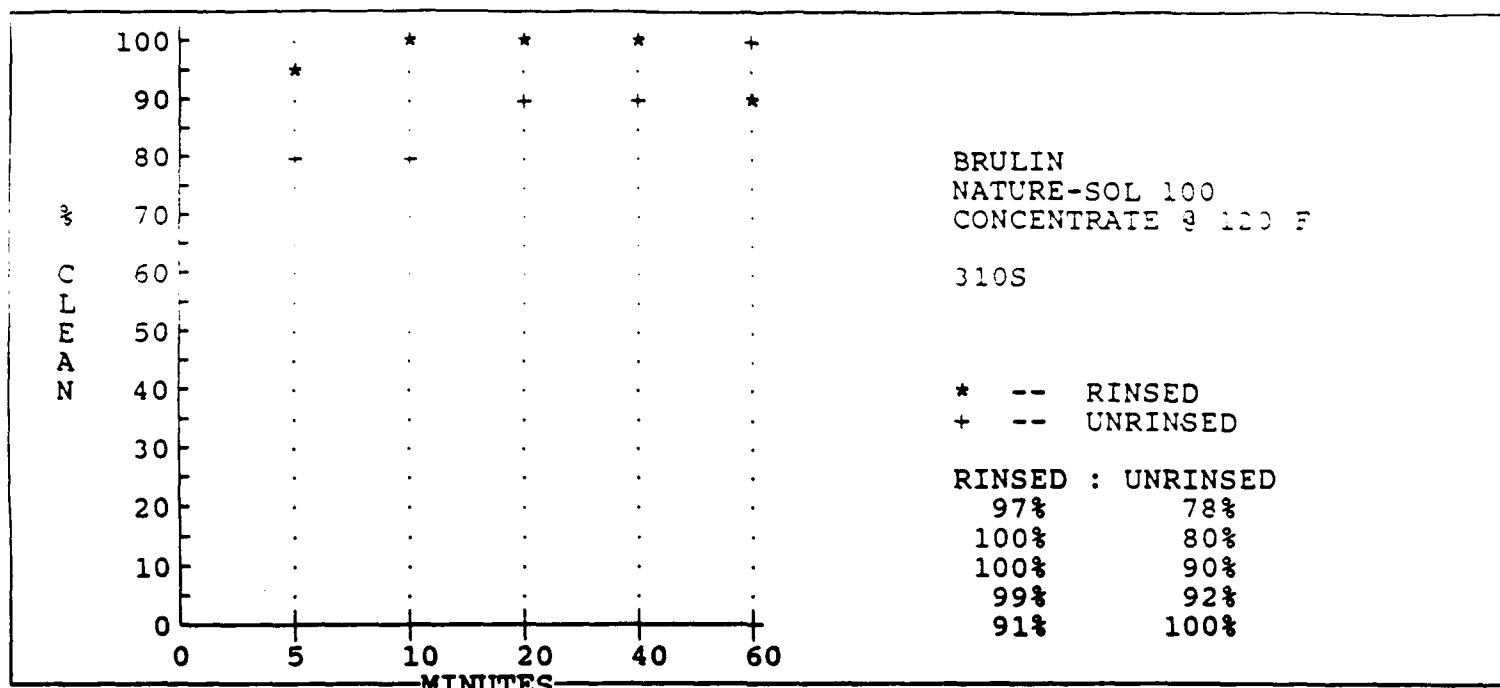
60%	14%
74%	48%
75%	59%
82%	64%
93%	69%

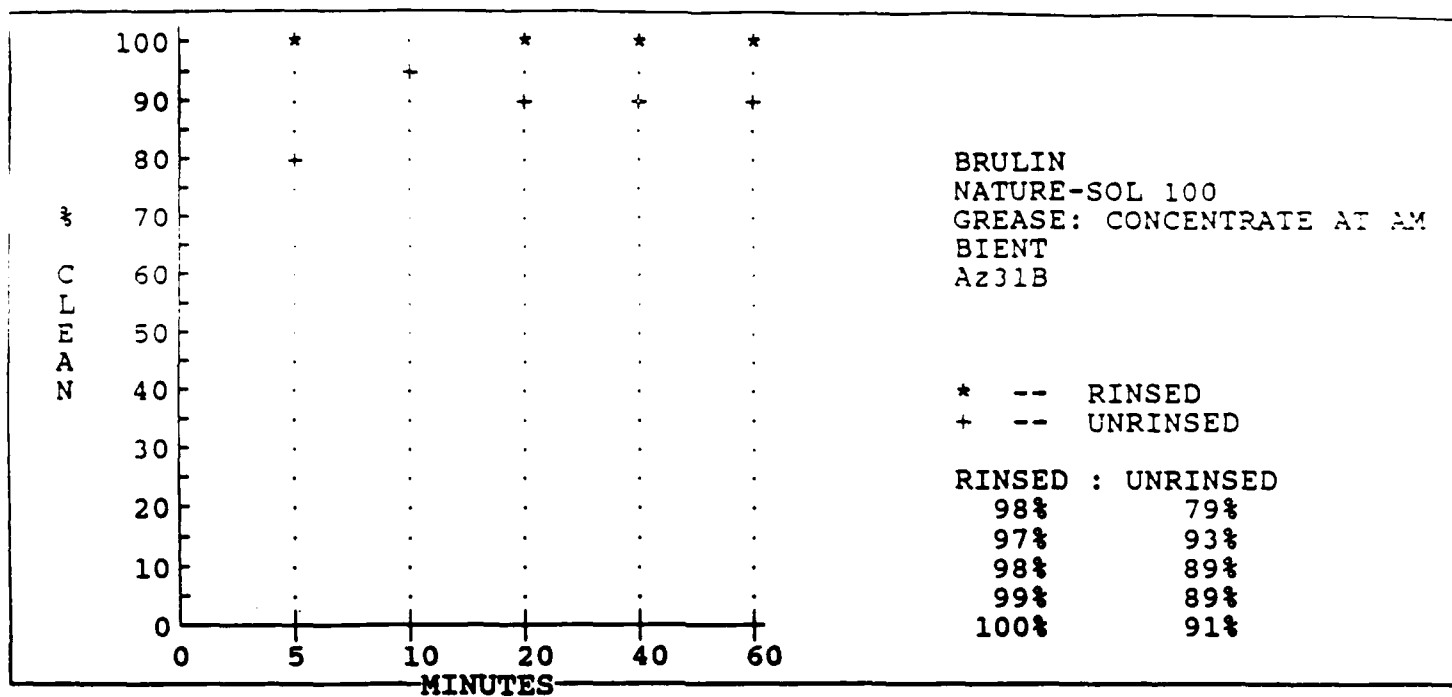






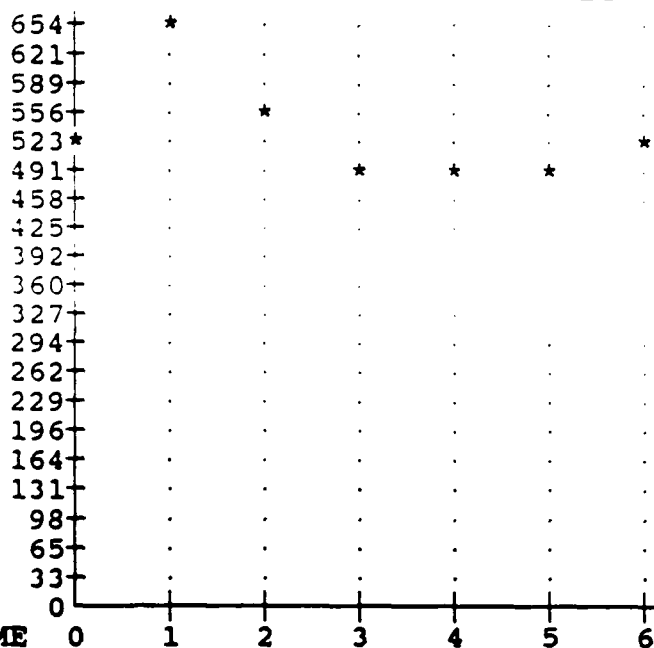






COMPANY - BUILD ALL
 PRODUCT - BAC #137
 TOC INIT- 80890
 TOC 2nd - 0
 COD INIT- 249500
 ANILINE PT - 0.0000
 ATP ----- 5 E-3

SOLUBILITY DATA:



0- 530
 1- 654
 2- 553
 3- 435
 4- 437
 5- 432
 6- 511

DRY
 WEIGHT
 0.0545

DATE - 06/14/88

COD vs TIME

PHENOL
 06/14/88
 ATP - 91 E-8

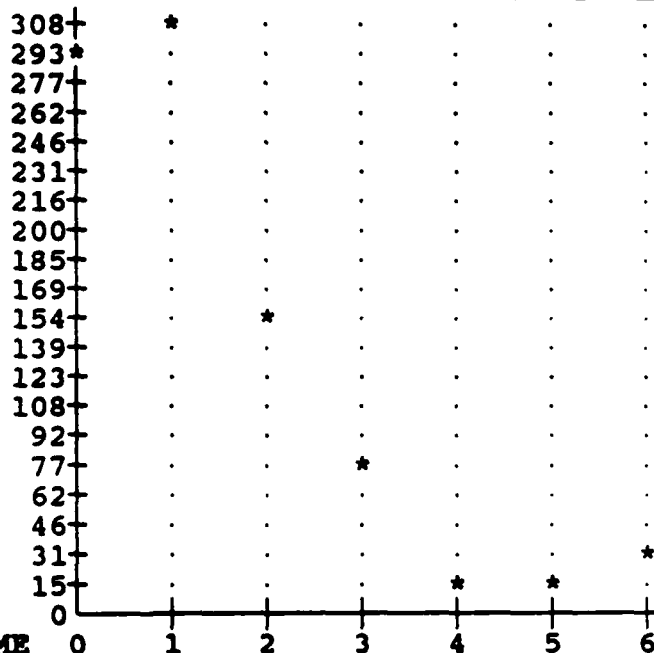
BIO-TEK INC.
 122 QUIK

BIO-TEK INC.
 126 SONI-CLEAN

BRULIN
 FORMULA 512M

BUILD ALL
 BAC #137

HYLUBE INC.
 ALKAKLEEN 658

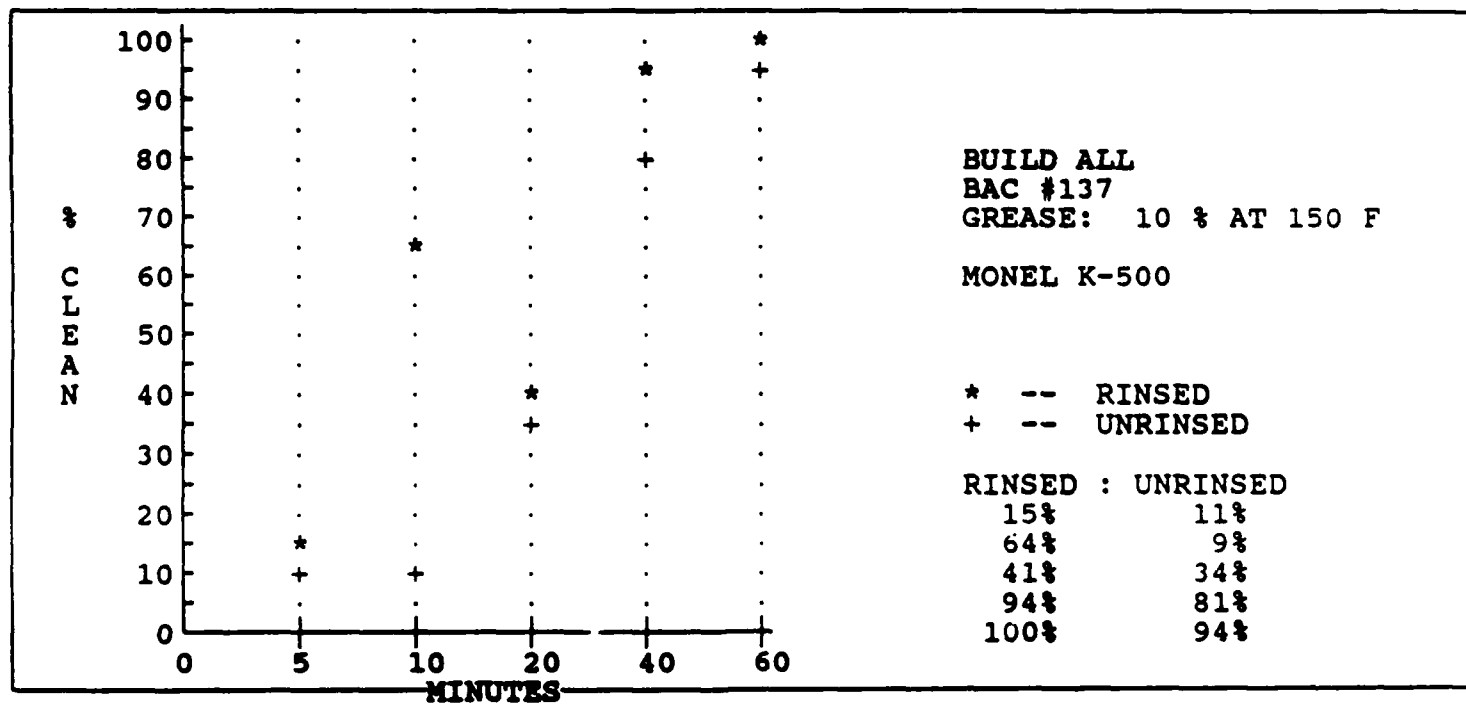
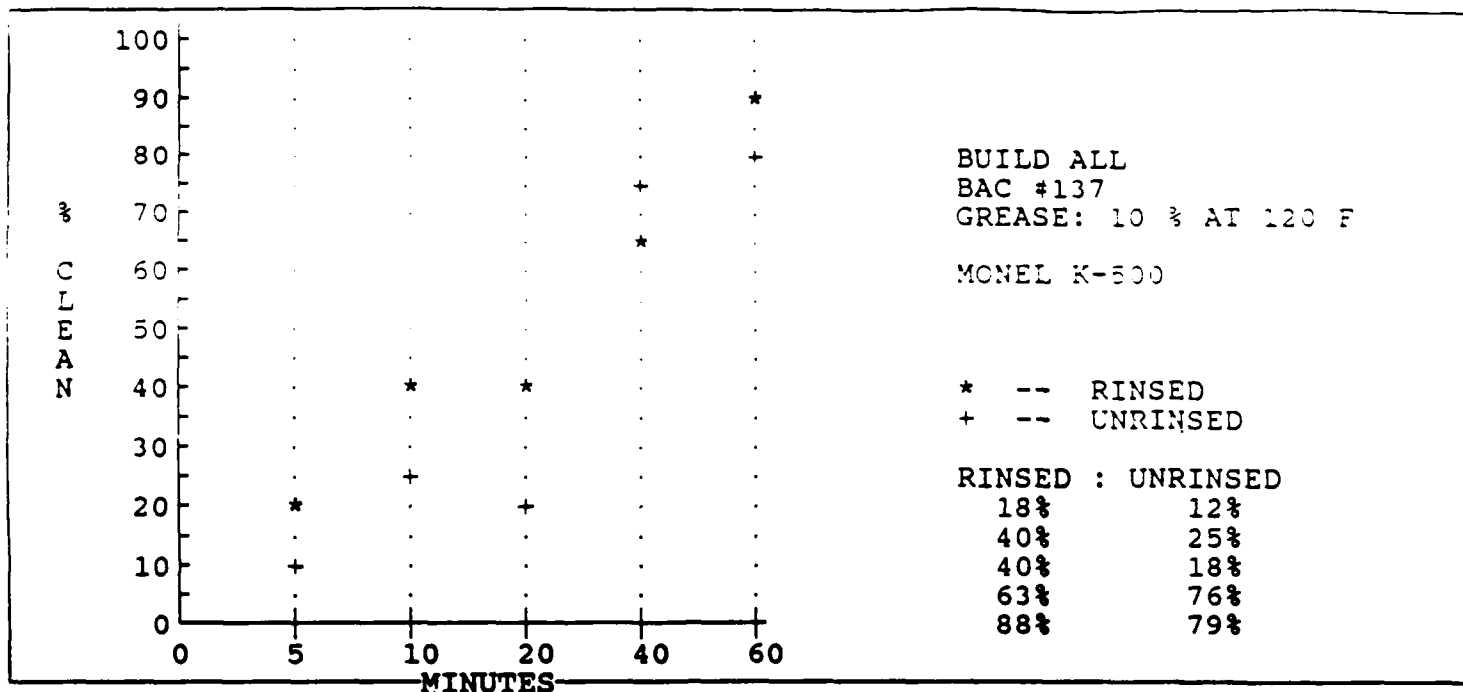


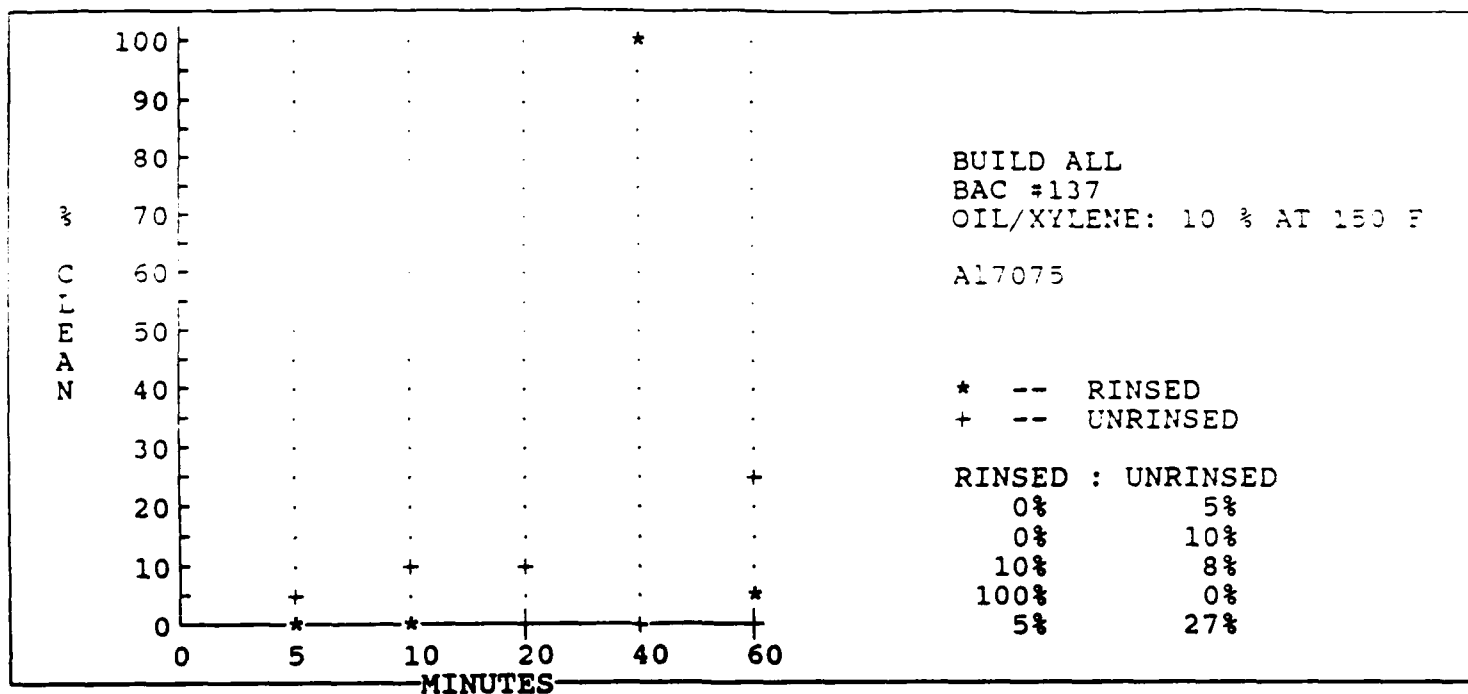
0- 290
 1- 308
 2- 156
 3- 70
 4- 9
 5- 10
 6- 31

DRY
 WEIGHT
 0.0545

DATE - 06/14/88

COD vs TIME





COMPANY - CABOT CHEMICAL COR 612*
 PRODUCT - X-166 581+
 TOC INIT- 88190 551+
 TOC 2nd - 41 520+
 COD INIT- 1-6500 490+
 ANILINE PT - 0.0000 459+
 ATP ----- -8 E-3 428+

SOLUBILITY DATA:

398+
 367+
 337+
 306+
 275+
 245+
 214+
 184+
 153+
 122+
 92+
 61+
 31+
 0

0- 612
 1- 562
 2- 592
 3- 573
 4- 566
 5- 590
 6- 518

DRY
 WEIGHT
 0.0764

DATE - 06/15/88 COD vs TIME 0 1 2 3 4 5 6

PHENOL
 06/15/88
 ATP - -19 E-8

BRULIN
 711 SC

CABOT CHEMICAL CORP.
 X-166

CALLA CHEMICAL CORP
 CALLA 301-A

CALLA CHEMICAL CORP
 CALLA 800

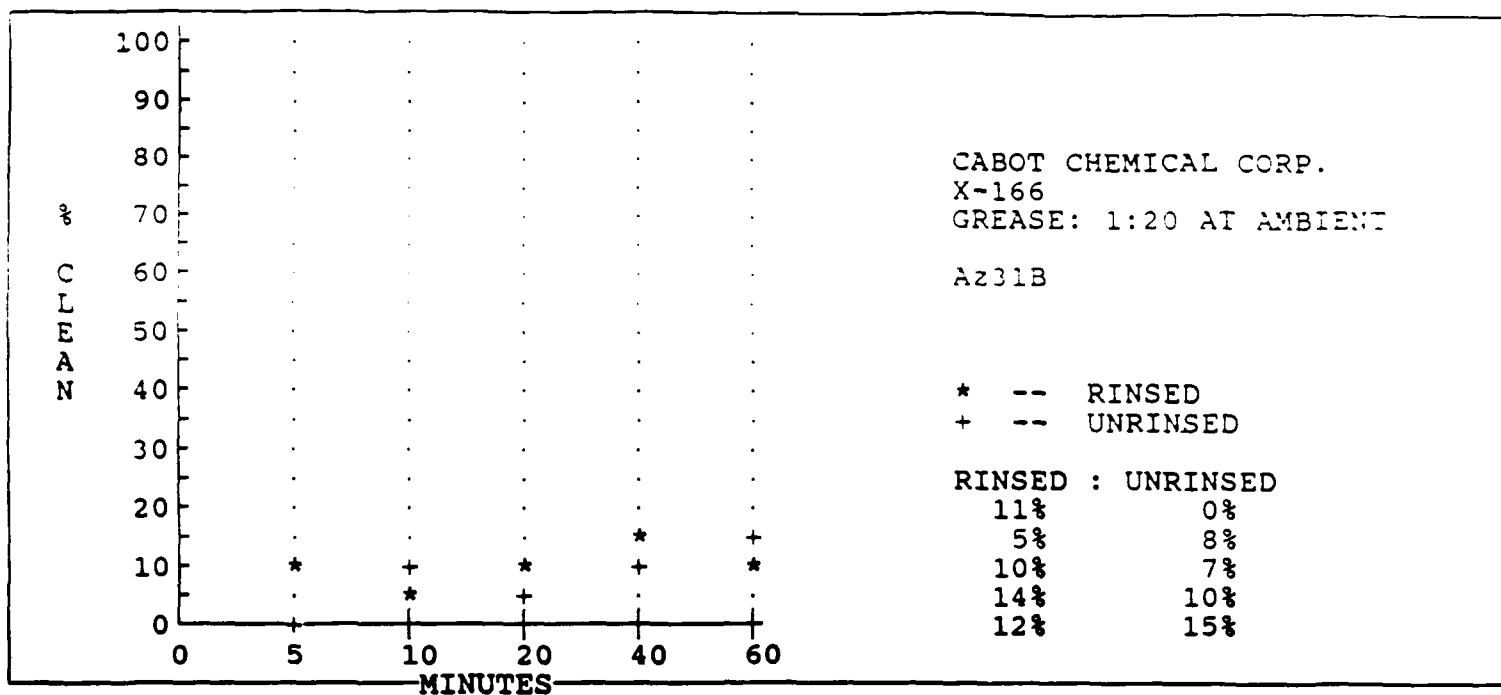
DOBER CHEMICAL CORP.
 4190

254*
 241+
 229+
 216+
 203+
 191+
 178+
 165+
 152+
 140+
 127+
 114+
 102+
 89+
 76+
 64+
 51+
 38+
 25+
 13+
 0

0- 254
 1- 187
 2- 107
 3- 32
 4- 20
 5- 16
 6- 50

DRY
 WEIGHT
 0.0764

DATE - 06/15/88 COD vs TIME 0 1 2 3 4 5 6



COMPANY - CALLA CHEMICAL COR 890
 PRODUCT - CALLA 301 846
 TOC INIT- 87188 801*
 TOC 2nd - 0 757
 COD INIT- 32500 712
 ANILINE PT - 0.0000 668
 ATP ----- 22 E-3 623

SOLUBILITY DATA:

579
 534
 490
 445
 401
 356
 312
 267
 223
 178
 134
 89
 45
 0

0- 320
 1- 313
 2- 312
 3- 339
 4- 350
 5- 353
 6- 351

DRY
 WEIGHT
 0.0607

DATE - 12/20/89 COD vs TIME 0 1 2 3 4 5 6

PHENOL
 12/20/89
 ATP - 185 E-8

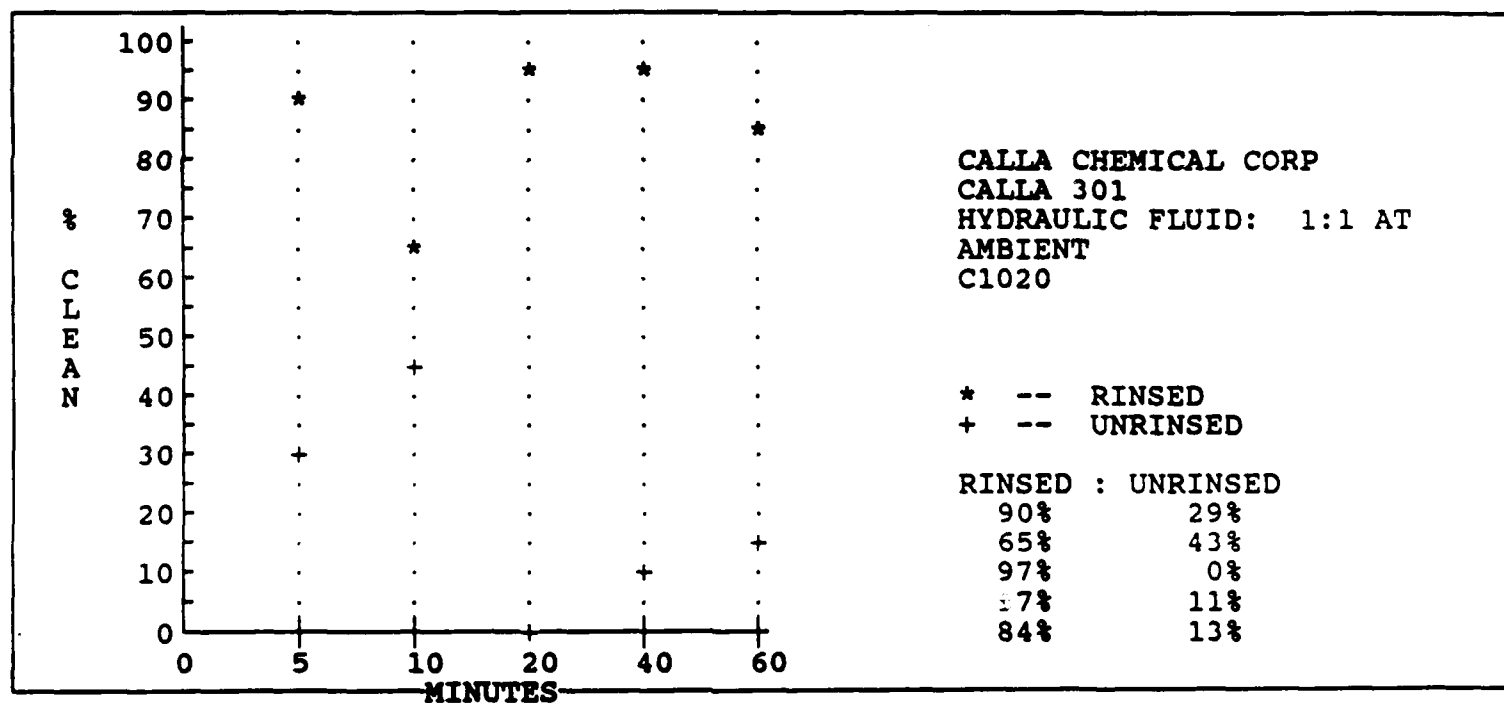
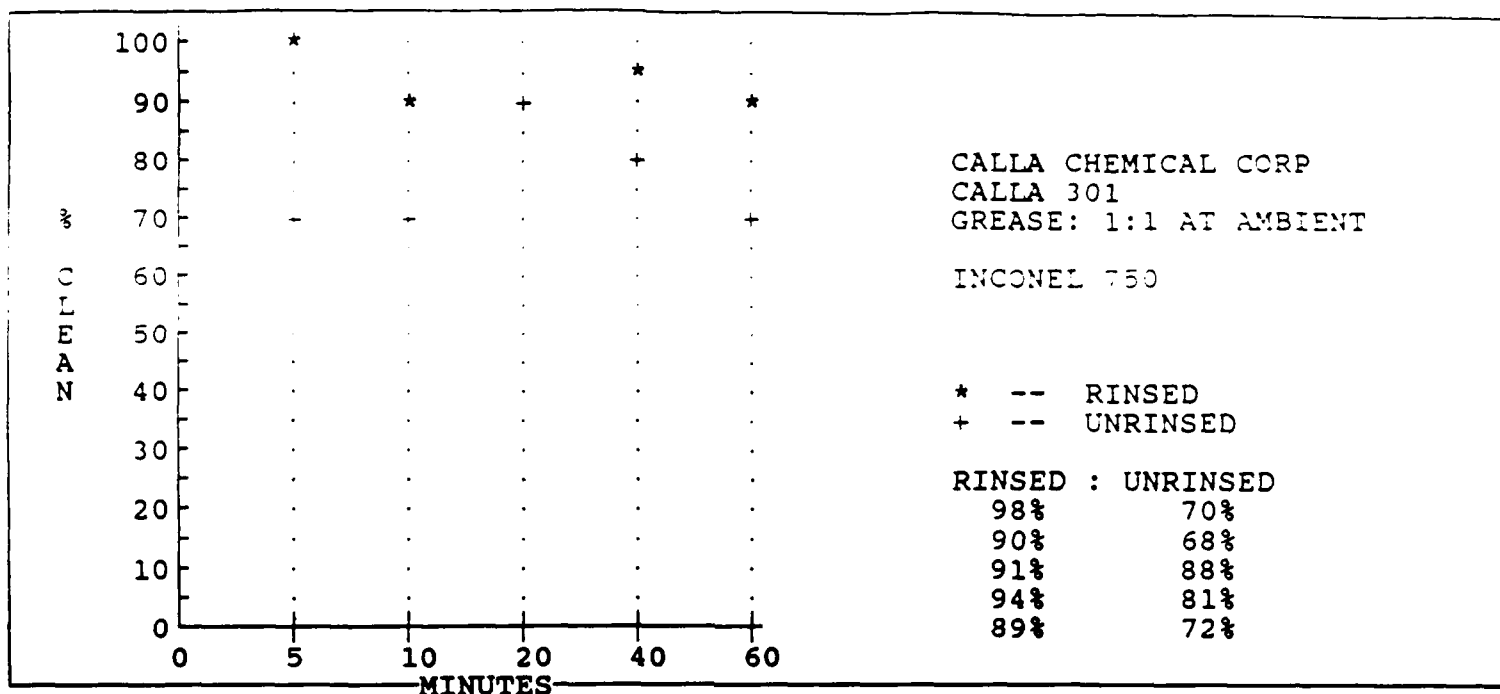
CALLA CHEMICAL CORP
 CALLA 301

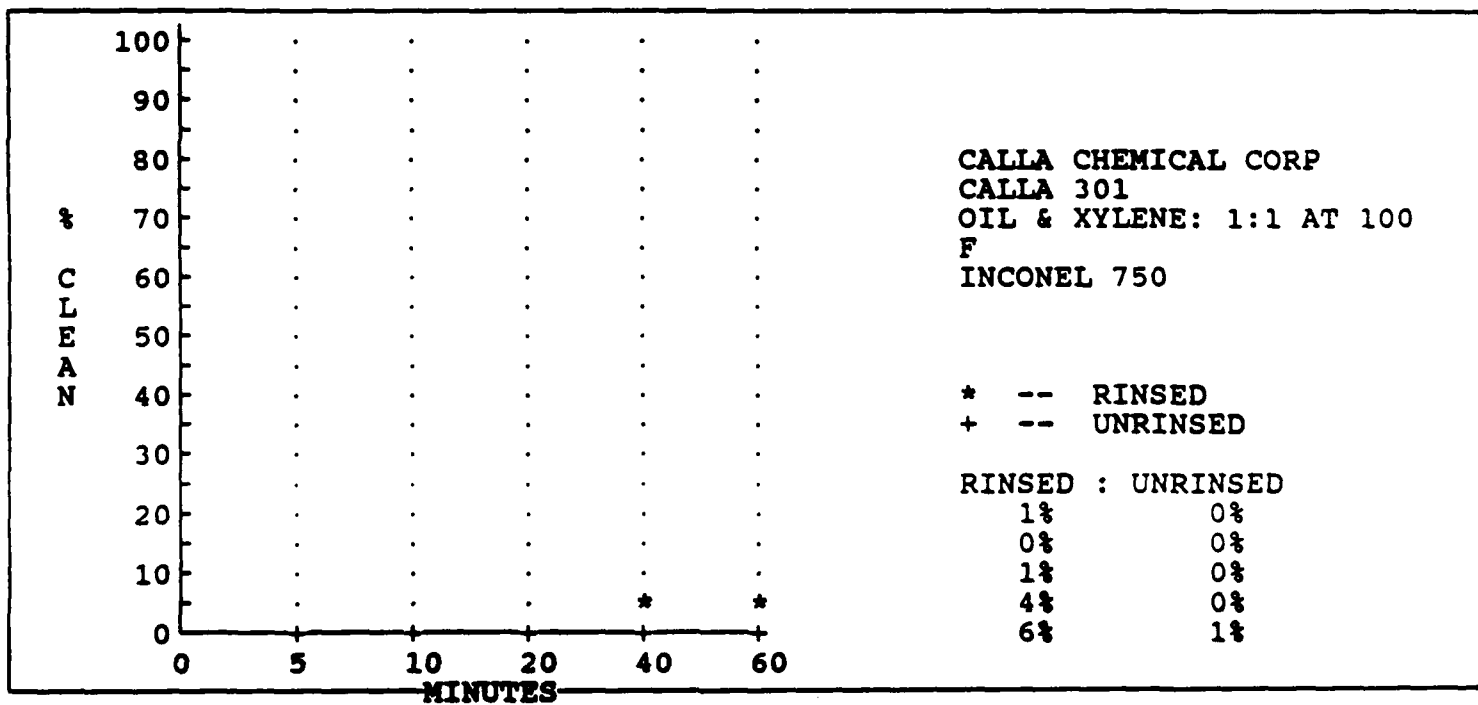
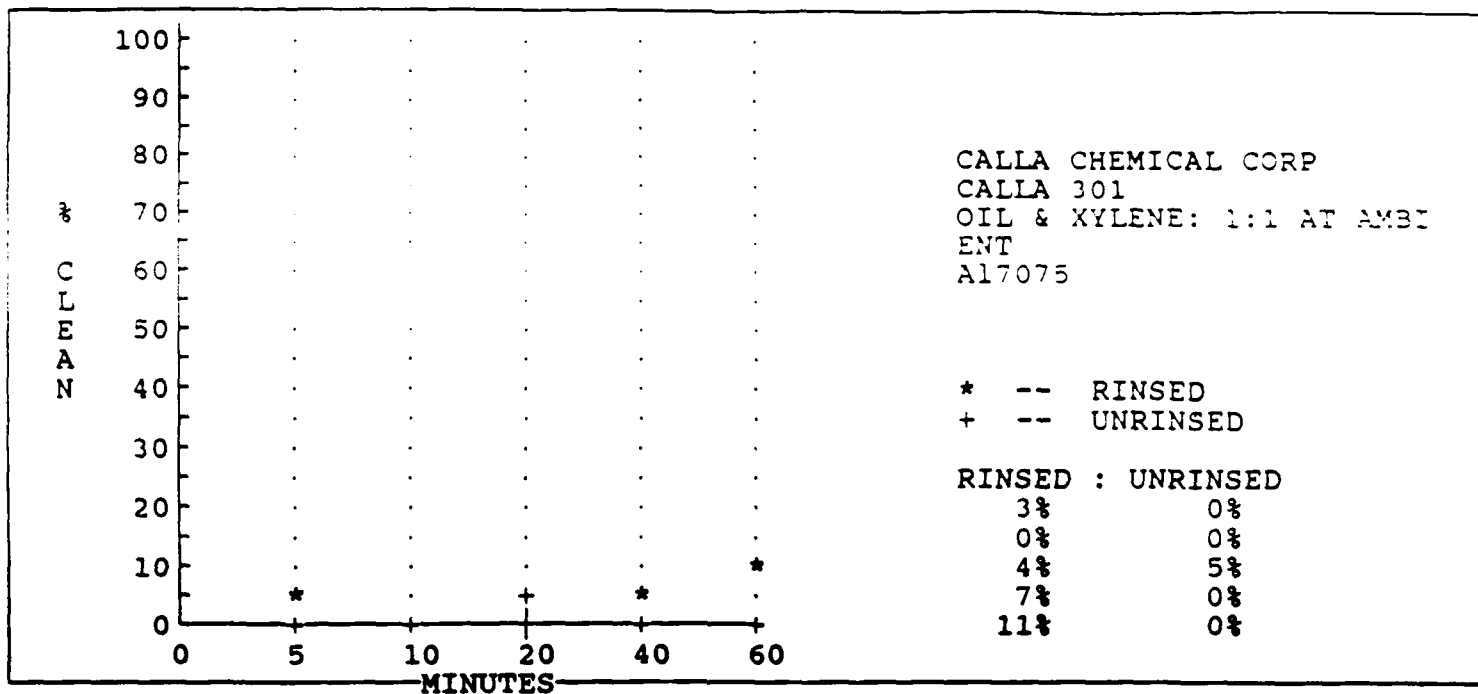
284*
 270
 256*
 241
 227
 213
 199
 185
 170
 156
 142
 128
 114
 99
 85
 71
 57
 43
 28
 14
 0

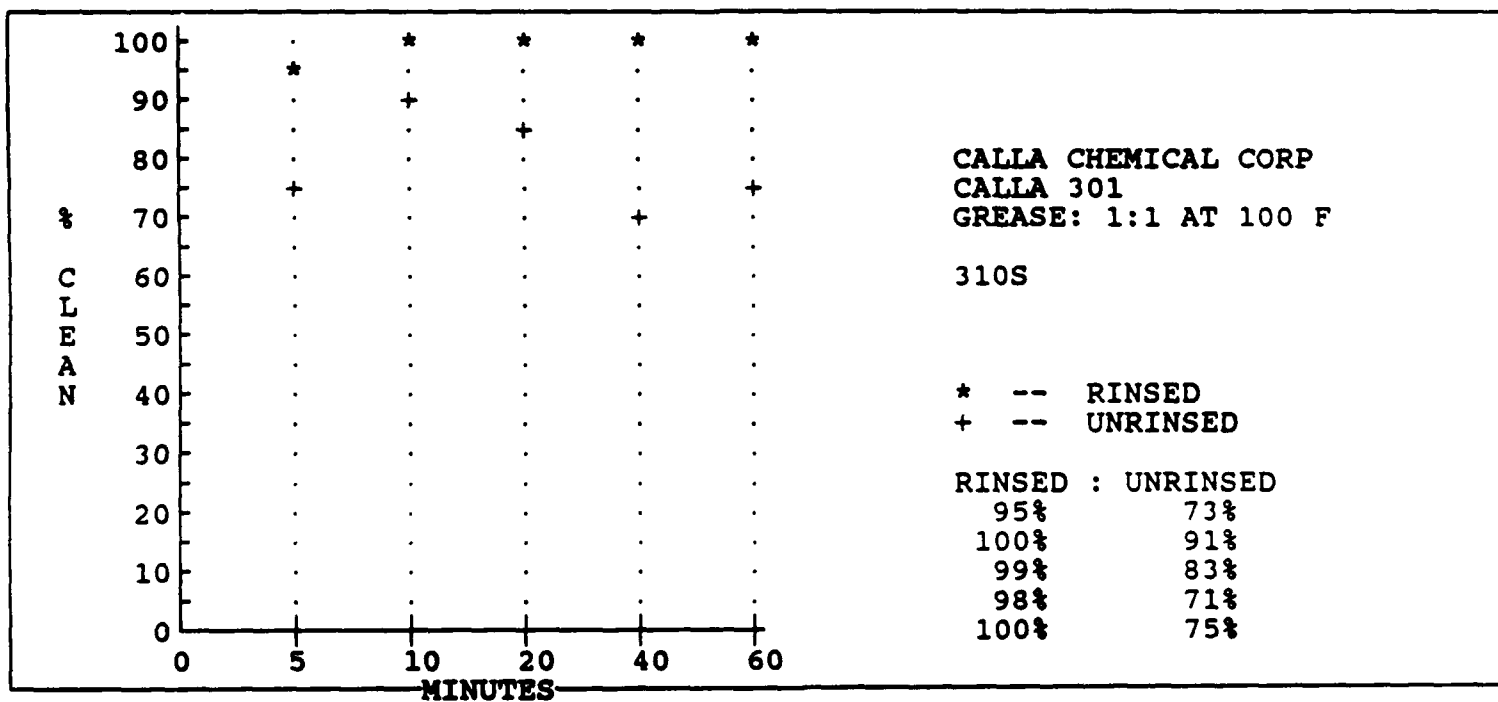
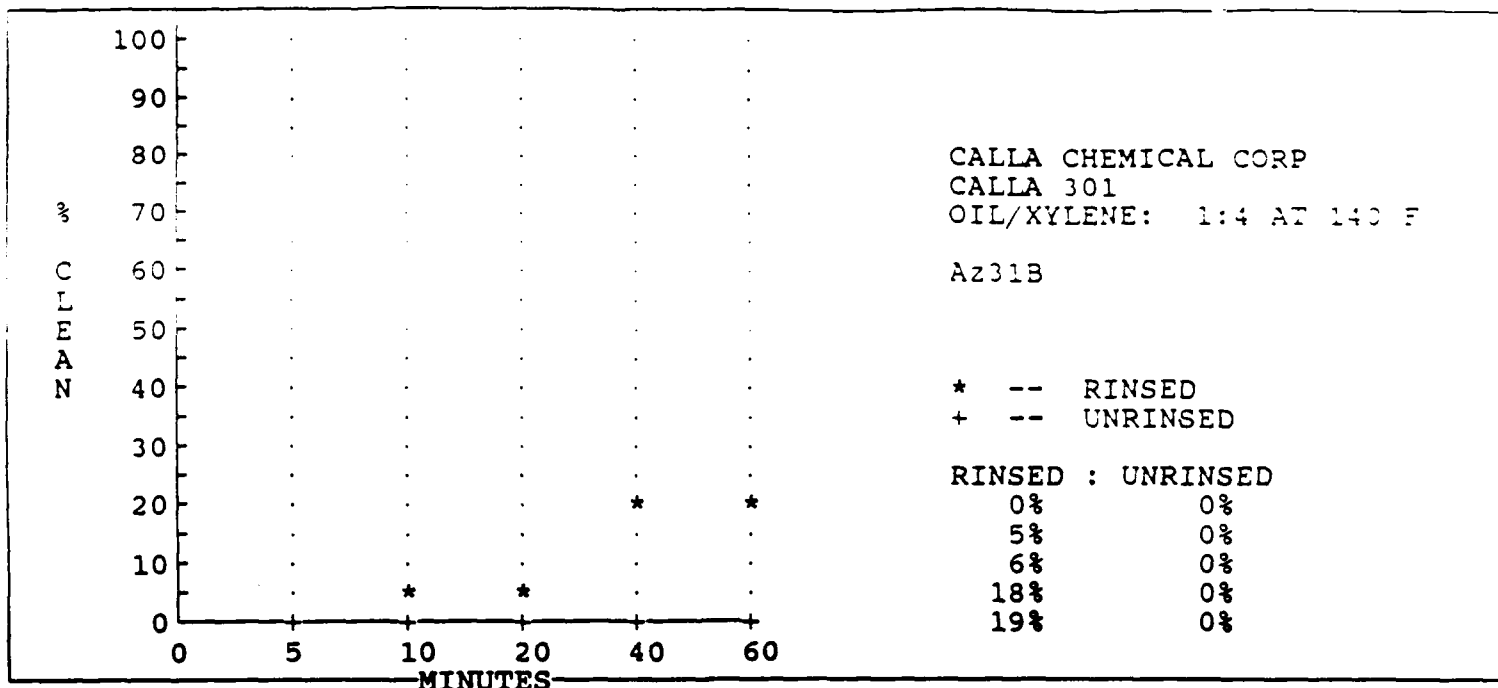
0- 284
 1- 262
 2- 271
 3- 206
 4- 164
 5- 133
 6- 86

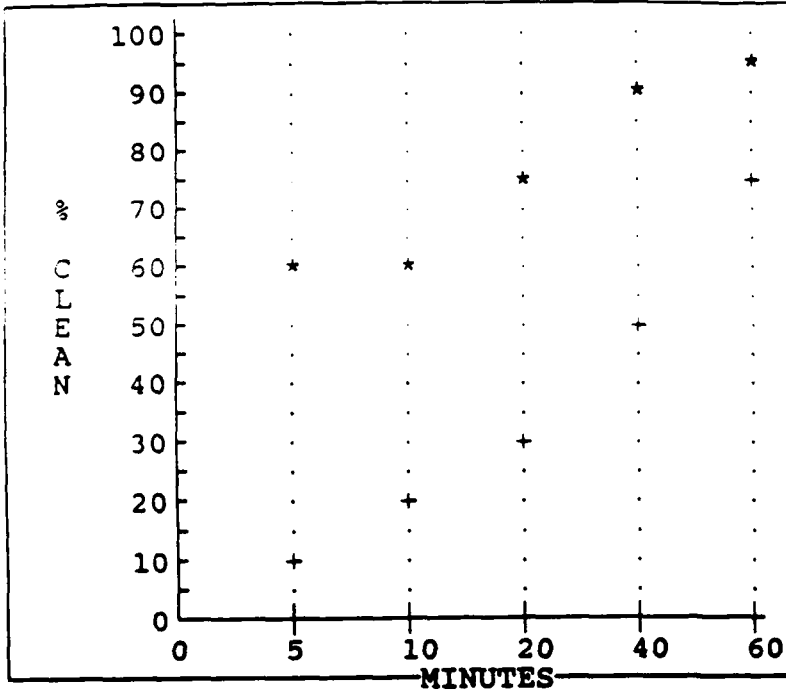
DRY
 WEIGHT
 0.0607

DATE - 12/20/89 COD vs TIME 0 1 2 3 4 5 6









CALLA CHEMICAL CORP
CALLA 301
HYDRAULIC FLUID: 1:1 AT
100 F
A12024

* -- RINSED
+ -- UNRINSED

RINSED : UNRINSED

62%	12%
61%	19%
77%	30%
91%	50%
96%	76%

COMPANY - CALLA CHEMICAL COR 668+
 PRODUCT - CALLA 301-A 635*
 TOC INIT- 89789 601-
 TOC 2nd - 0 568-
 COD INIT- 332500 534-
 ANILINE PT - 0.0000 501-
 ATP ----- 23 E-3 468-

SOLUBILITY DATA:

434-
 401-
 367-
 334-
 301-
 267-
 234-
 200-
 167-
 134-
 100-
 67-
 33-
 0

0- 632
 1- 538
 2- 543
 3- 668
 4- 572
 5- 556
 6- 580

DRY
 WEIGHT
 0.0403

DATE - 04/19/88 COD vs TIME 0 1 2 3 4 5 6

PHENOL
 04/19/88
 ATP - 0 E-8

BRULIN
 711 SC

CALLA CHEMICAL CORP
 CALLA 301-A

CALLA CHEMICAL CORP
 CALLA 800

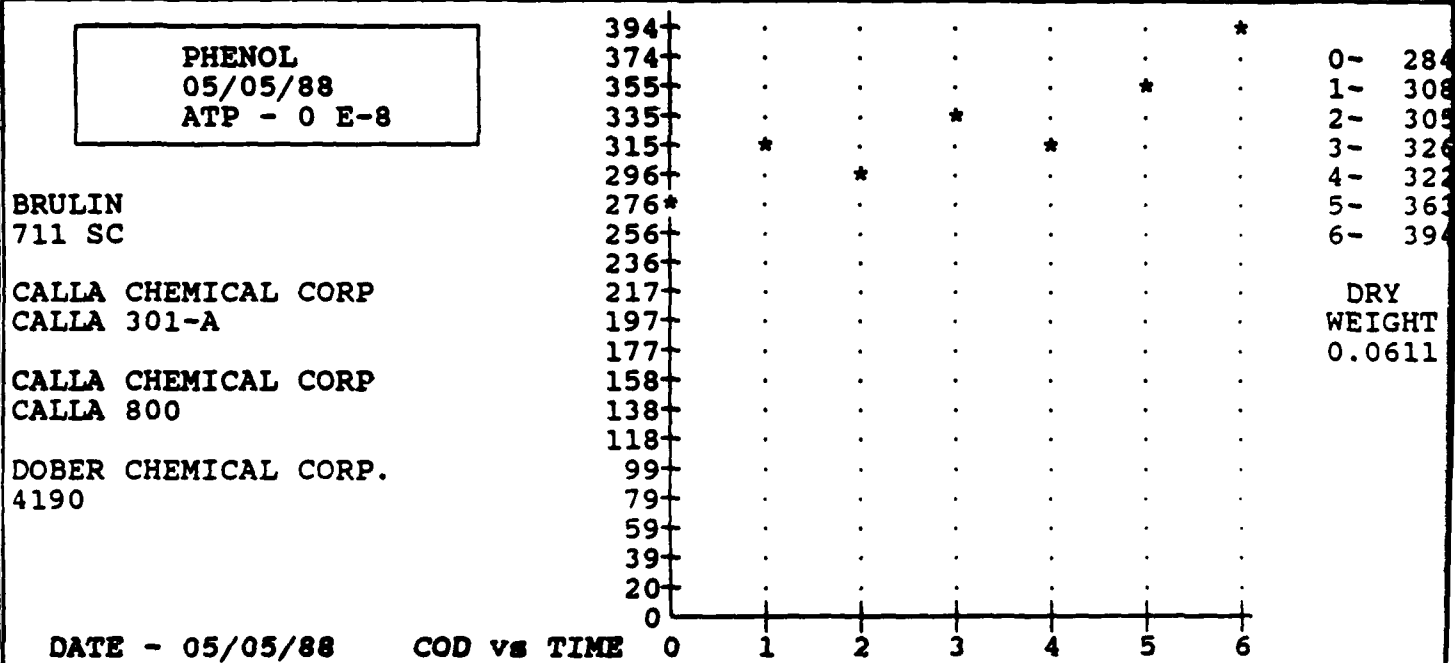
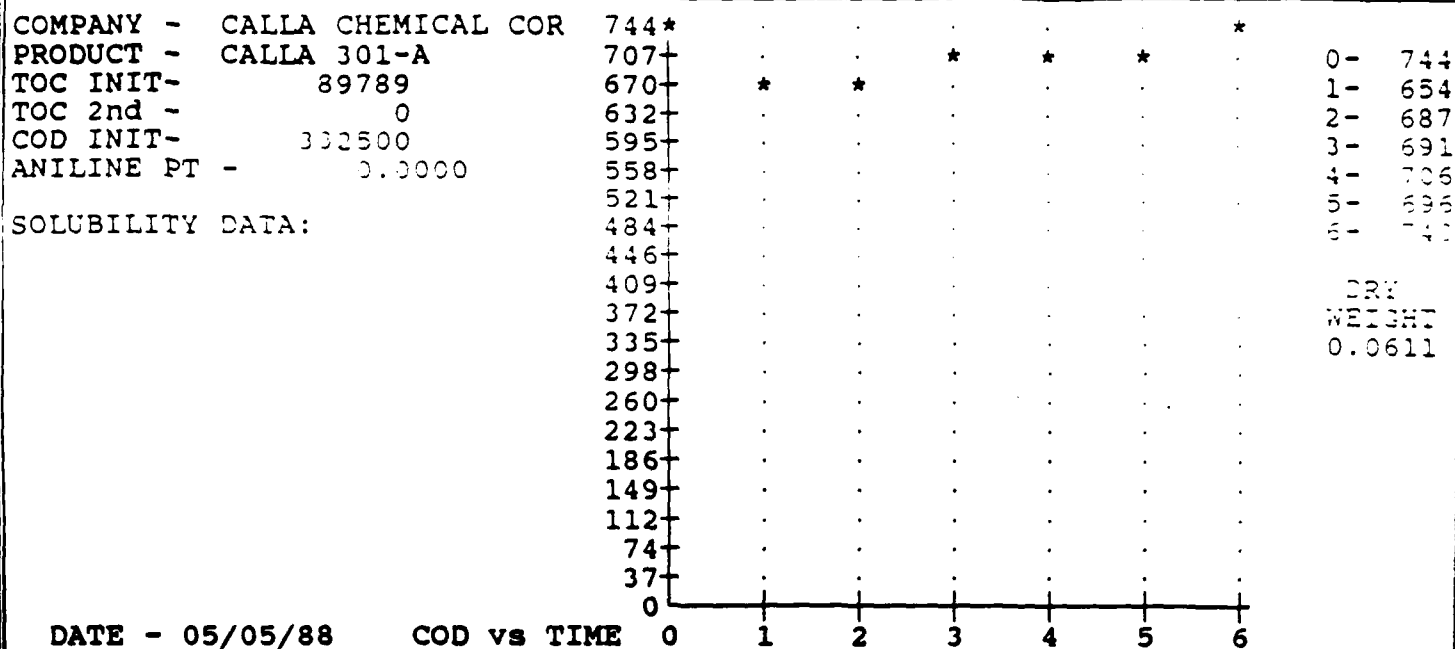
DOBER CHEMICAL CORP.
 4190

258*
 245+
 232-
 219-
 206-
 194-
 181-
 168-
 155-
 142-
 129-
 116-
 103-
 90-
 77-
 65-
 52-
 39-
 26-
 13-
 0

0- 258
 1- 178
 2- 0
 3- 75
 4- 14
 5- 54
 6- 0

DRY
 WEIGHT
 0.0403

DATE - 04/19/88 COD vs TIME 0 1 2 3 4 5 6



COMPANY - CALLA CHEMICAL COR 641*
 PRODUCT - CALLA 301-A 609+
 TOC INIT- 89789 577-
 TOC 2nd - 0 545-
 COD INIT- 332500 513-
 ANILINE PT - 0.0000 481-
 ATP ----- -10 E-3 449-
 417-

SOLUBILITY DATA:

385-
 353-
 321-
 288-
 256-
 224-
 192-
 160-
 128-
 96-
 64-
 32-
 0

0- 641
 1- 568
 2- 539
 3- 560
 4- 551
 5- 560
 6- 543

DRY
 WEIGHT
 0.0764

DATE - 06/15/88 COD vs TIME 0 1 2 3 4 5 6

PHENOL
 06/15/88
 ATP - -19 E-8

BRULIN
 711 SC

CABOT CHEMICAL CORP.
 X-166

CALLA CHEMICAL CORP
 CALLA 301-A

CALLA CHEMICAL CORP
 CALLA 800

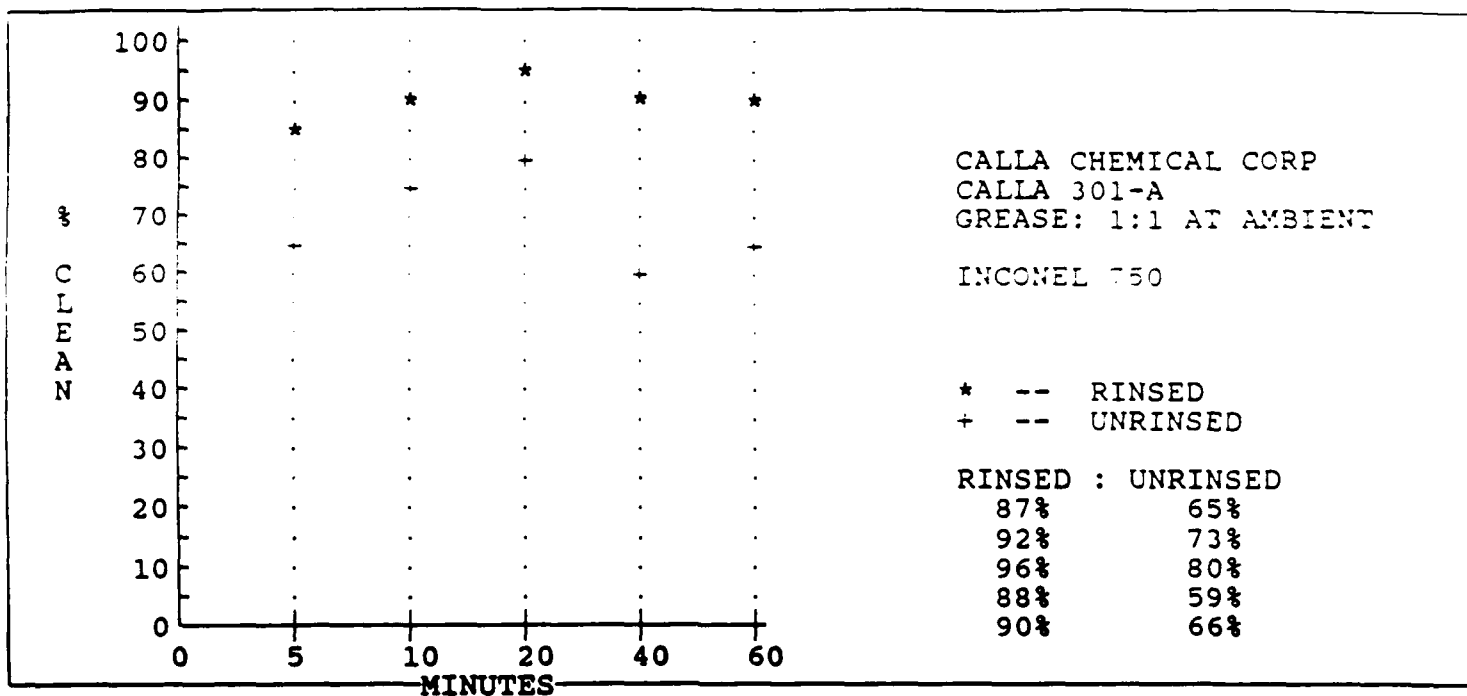
DOBER CHEMICAL CORP.
 4190

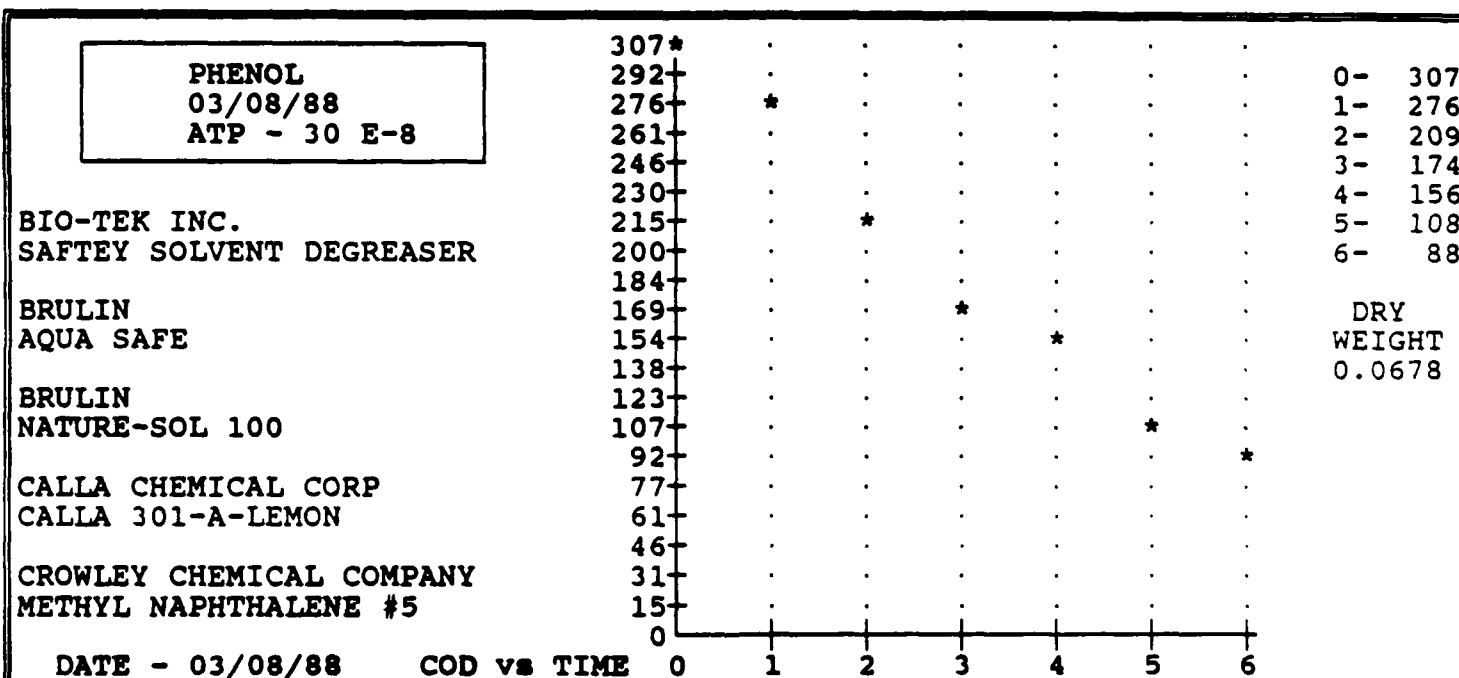
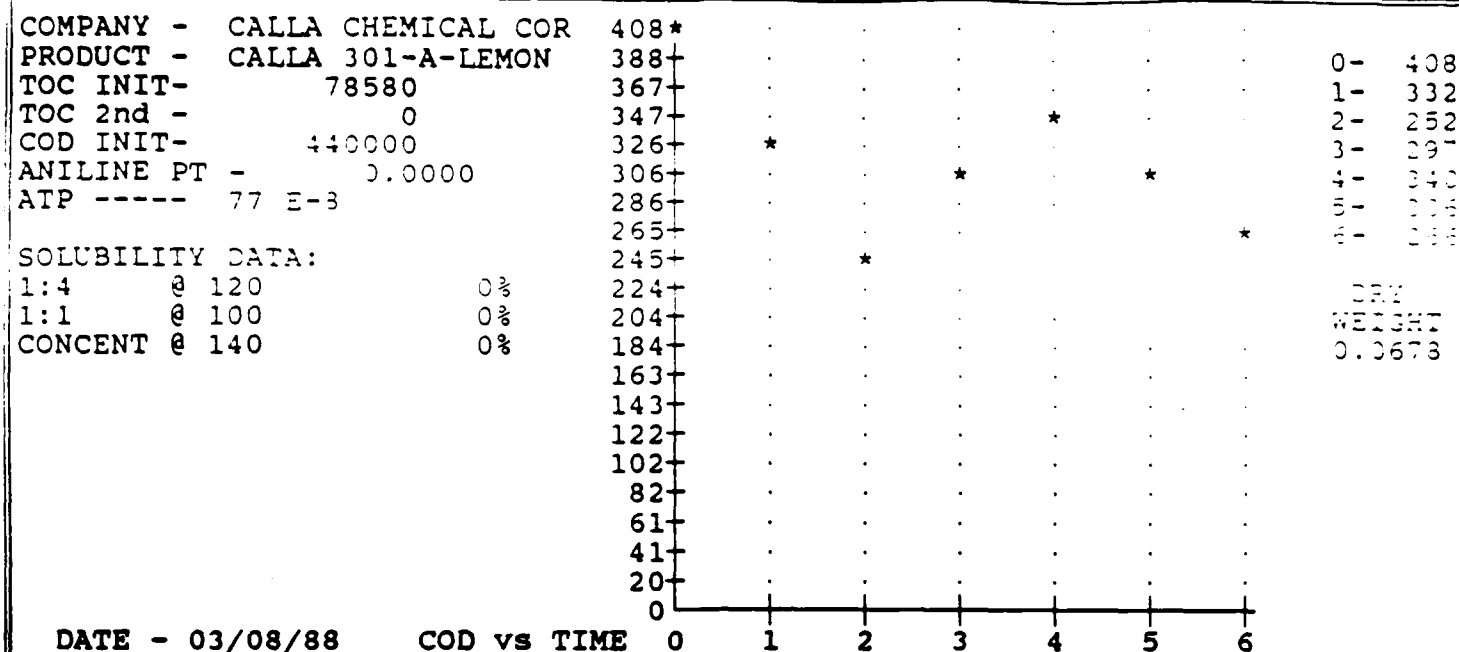
254*
 241-
 229-
 216-
 203-
 191-
 178-
 165-
 152-
 140-
 127-
 114-
 102-
 89-
 76-
 64-
 51-
 38-
 25-
 13-
 0

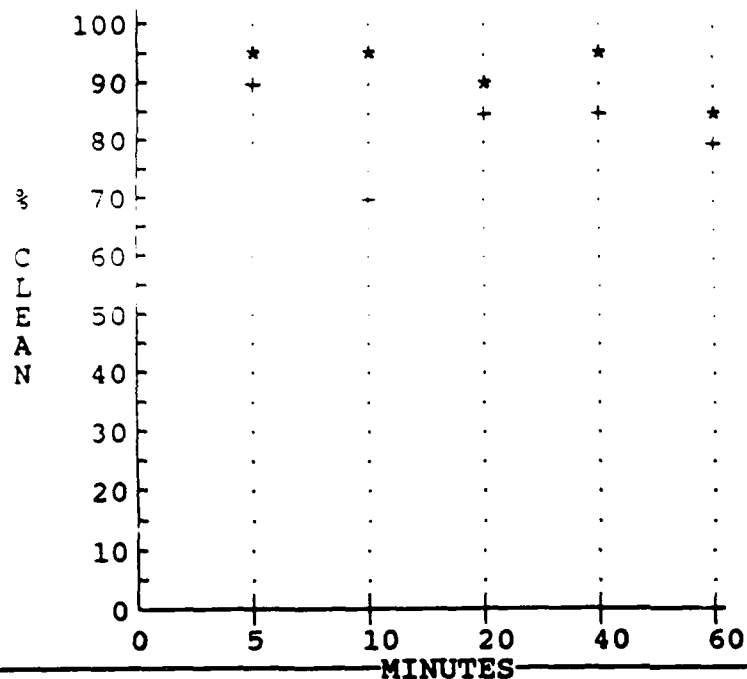
0- 254
 1- 187
 2- 107
 3- 32
 4- 20
 5- 16
 6- 50

DRY
 WEIGHT
 0.0764

DATE - 06/15/88 COD vs TIME 0 1 2 3 4 5 6







CALLA CHEMICAL CORP
CALLA 301-A-LEMON
GREASE: 1:1 AT AMBIENT

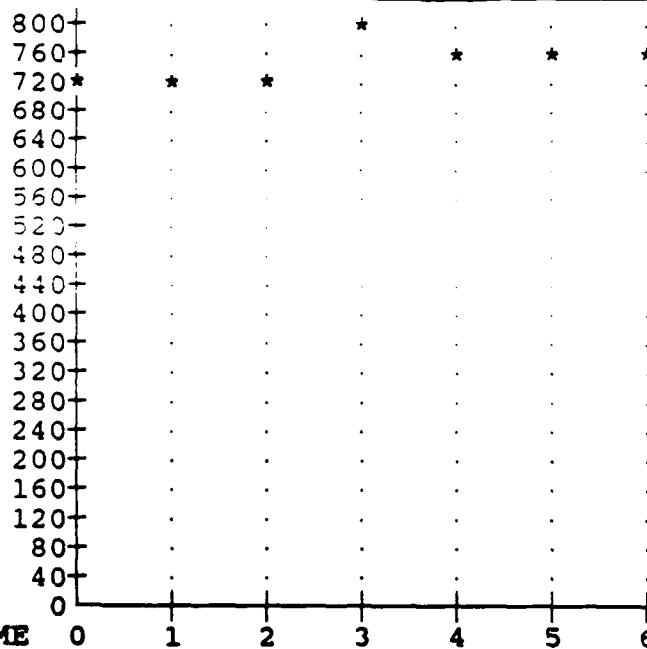
INCONEL 750

* -- RINSED
+ -- UNRINSED

RINSED : UNRINSED	
96%	88%
93%	71%
91%	86%
97%	83%
85%	79%

COMPANY - CALLA CHEMICAL COR
 PRODUCT - CALLA 800
 TOC INIT- 92405
 TOC 2nd - 62
 COD INIT- 235000
 ANILINE PT - 0.0000
 ATP ----- 5 E-3

SOLUBILITY DATA:



0- 732
 1- 740
 2- 738
 3- 800
 4- 773
 5- 746
 6- 754

DRY
 WEIGHT
 0.0403

DATE - 04/19/88

COD vs TIME

0 1 2 3 4 5 6

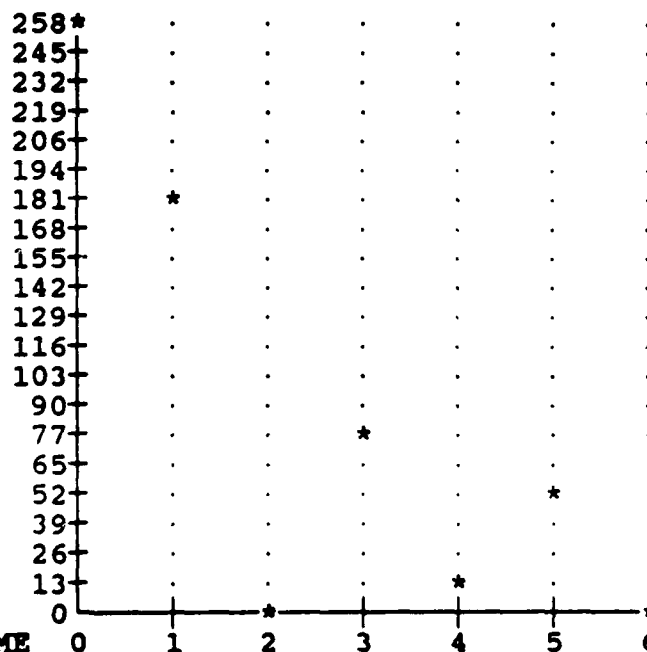
PHENOL
 04/19/88
 ATP - 0 E-8

BRULIN
 711 SC

CALLA CHEMICAL CORP
 CALLA 301-A

CALLA CHEMICAL CORP
 CALLA 800

DOBER CHEMICAL CORP.
 4190



0- 258
 1- 178
 2- 0
 3- 75
 4- 14
 5- 54
 6- 0

DRY
 WEIGHT
 0.0403

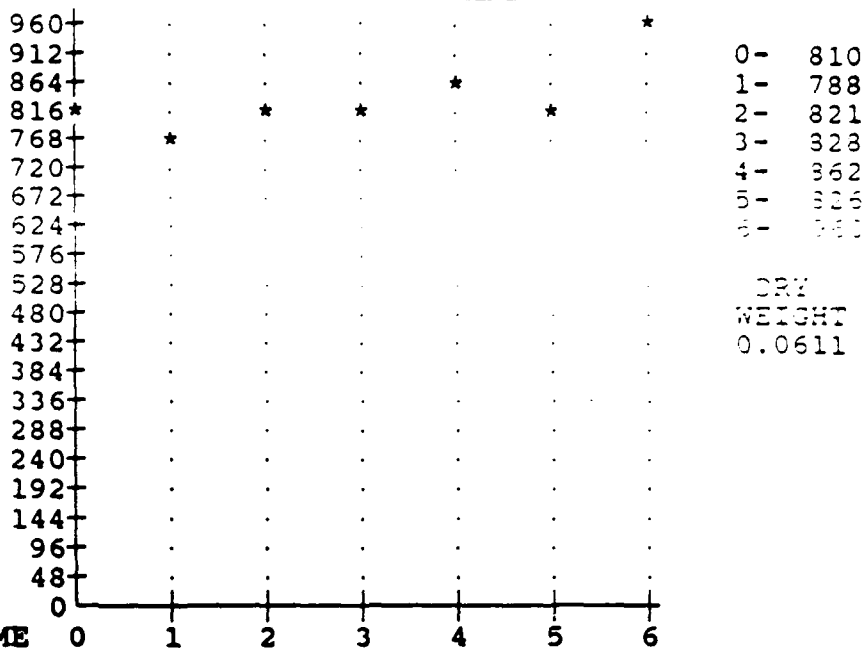
DATE - 04/19/88

COD vs TIME

0 1 2 3 4 5 6

COMPANY - CALLA CHEMICAL COR
 PRODUCT - CALLA 800
 TOC INIT- 92405
 TOC 2nd - 52
 COD INIT- 235000
 ANILINE PT - 0.0000

SOLUBILITY DATA:



DATE - 05/05/88

COD vs TIME

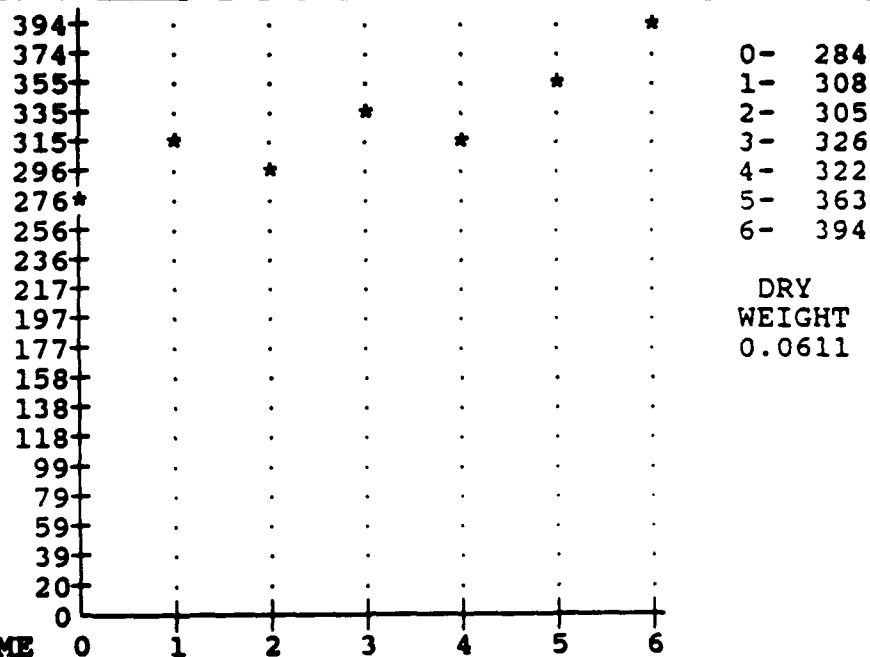
PHENOL
 05/05/88
 ATP - 0 E-8

BRULIN
 711 SC

CALLA CHEMICAL CORP
 CALLA 301-A

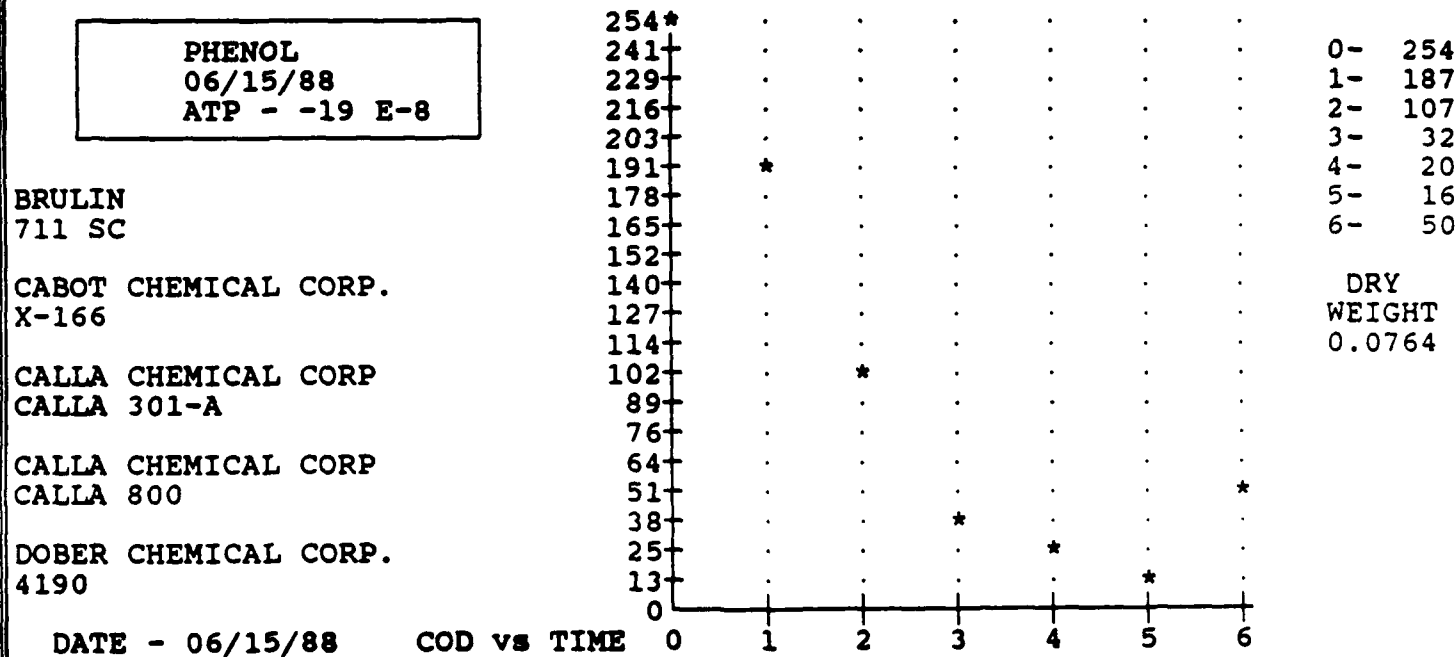
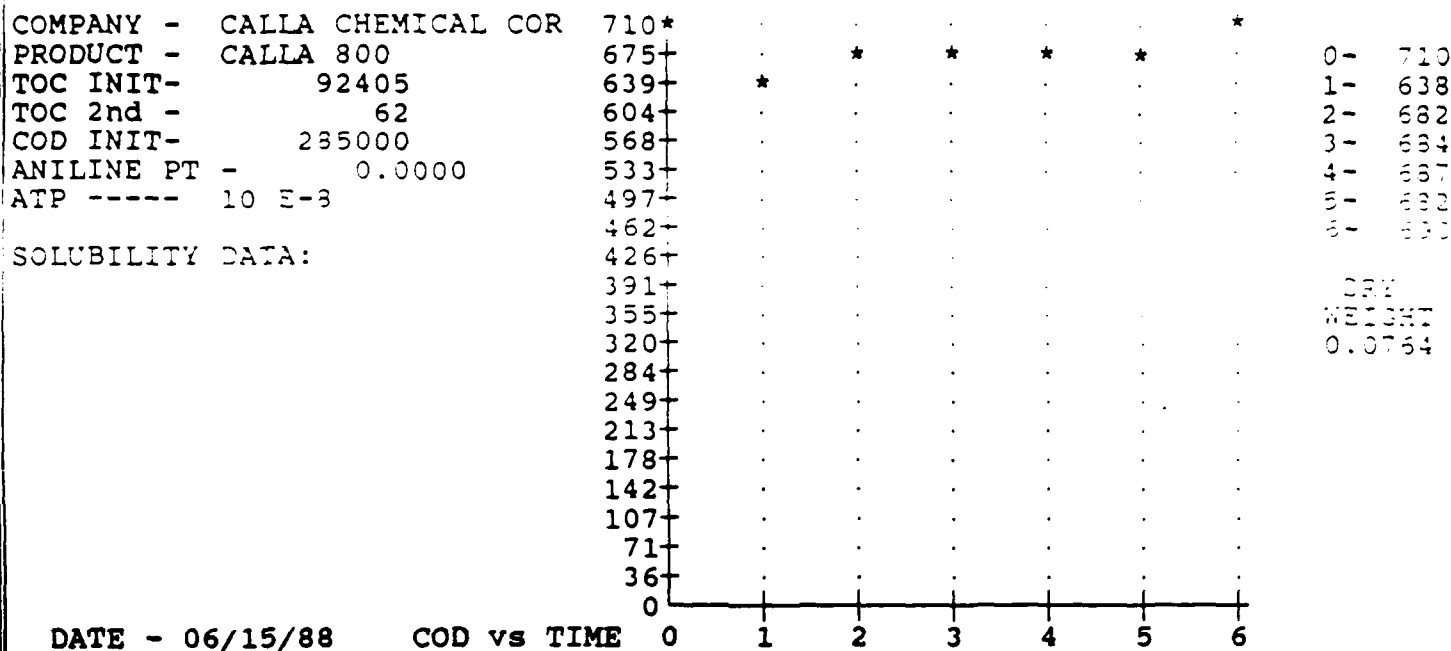
CALLA CHEMICAL CORP
 CALLA 800

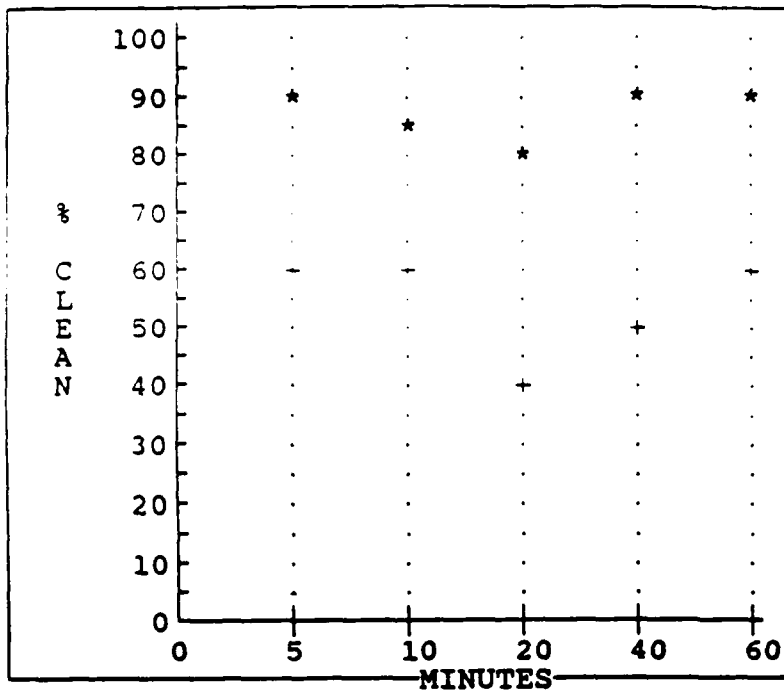
DOBER CHEMICAL CORP.
 4190



DATE - 05/05/88

COD vs TIME

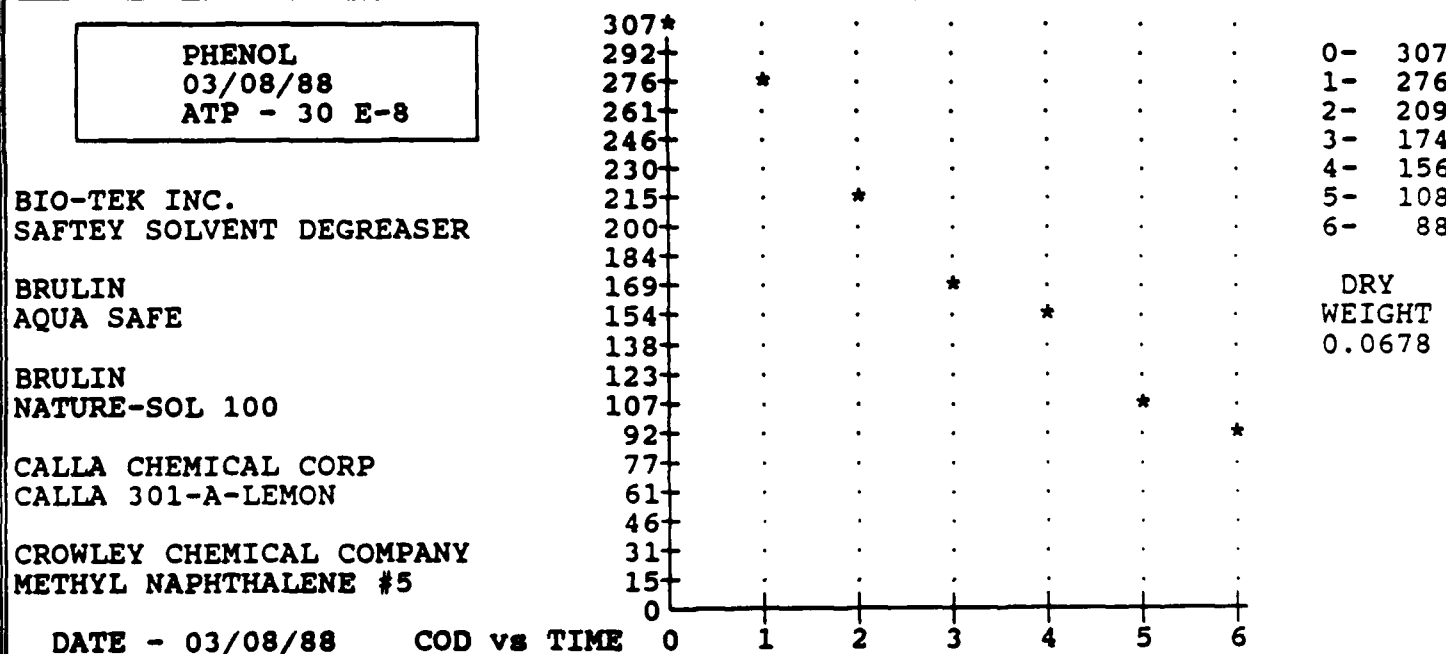
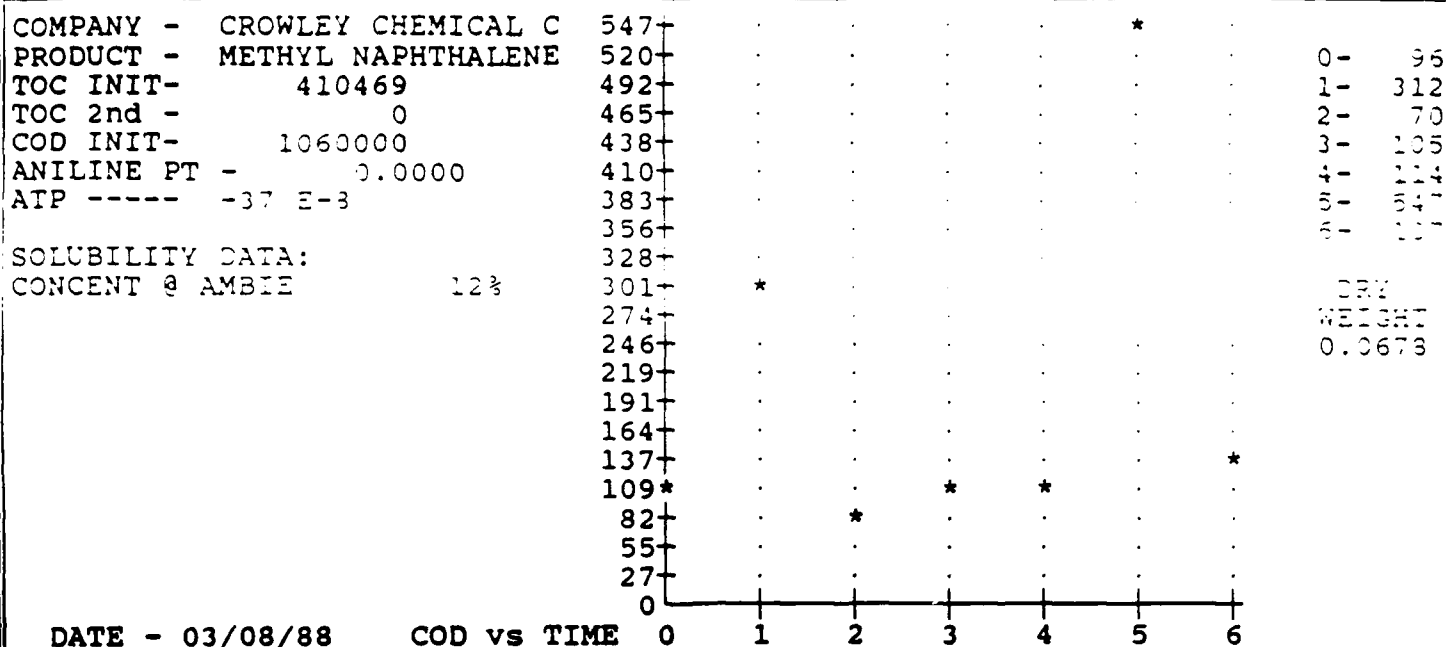


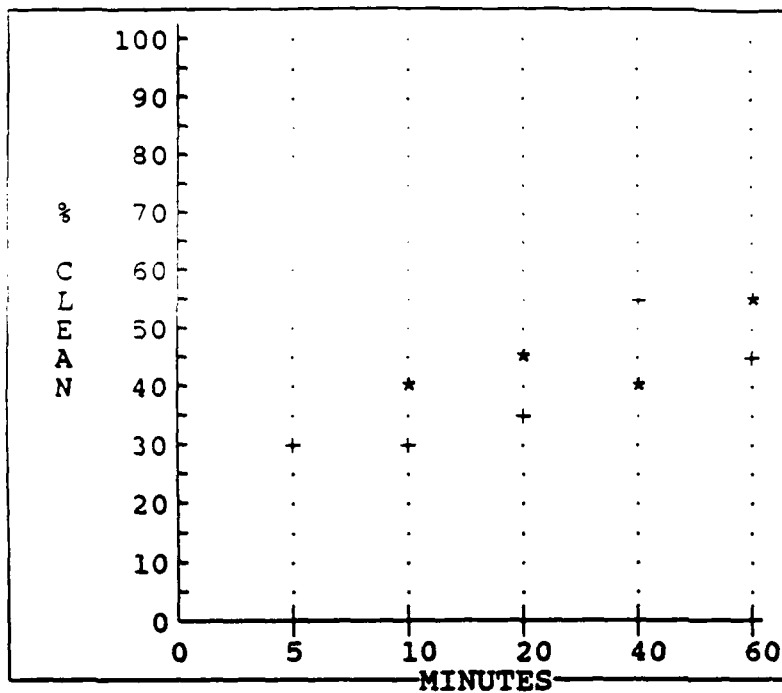


CALLA CHEMICAL CORP
CALLA 800
GREASE: CONCENTRATE AT A
MBIENT
INCONEL 750

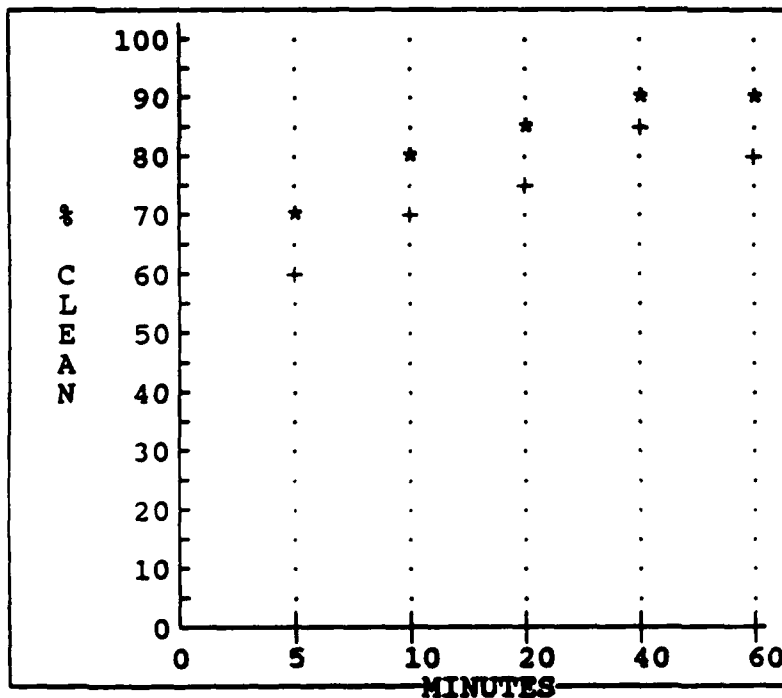
* -- RINSED
+ -- UNRINSED

RINSED : UNRINSED
92% : 61%
85% : 61%
82% : 39%
91% : 50%
92% : 58%

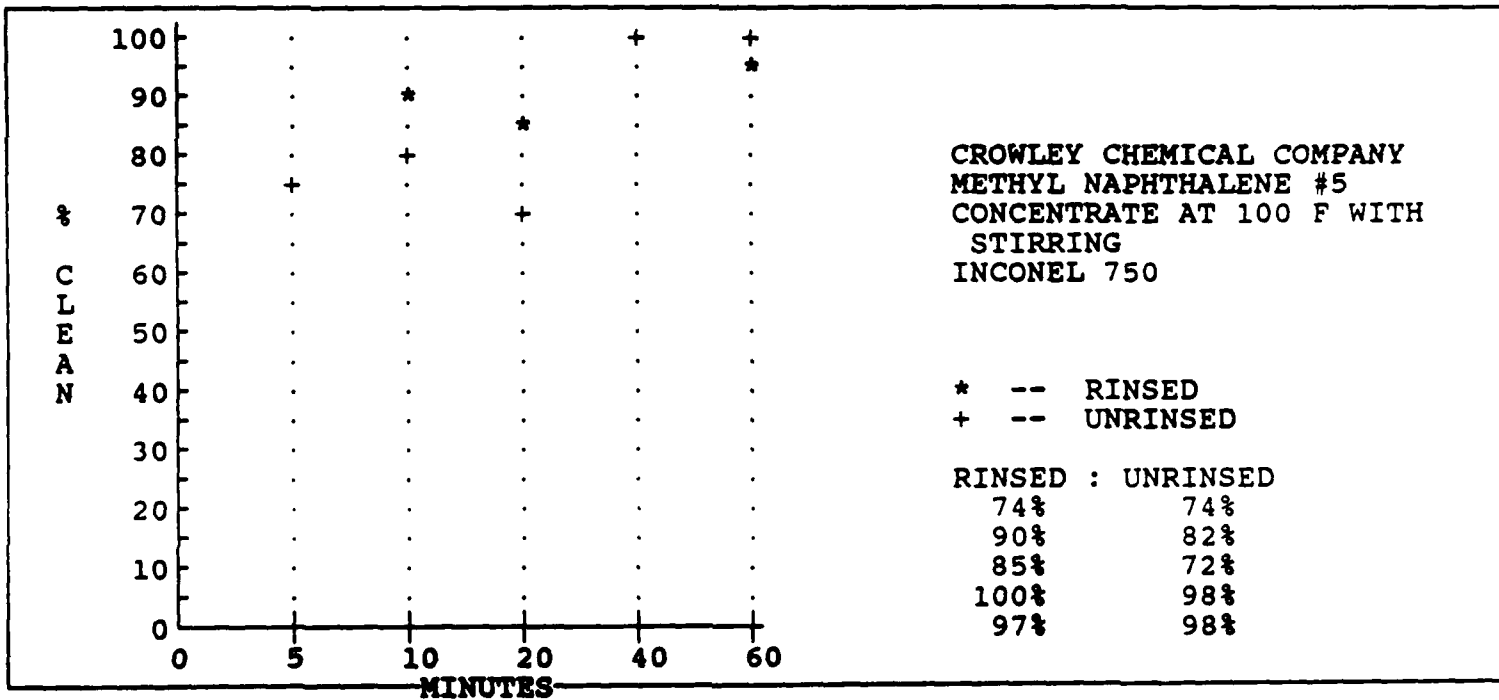
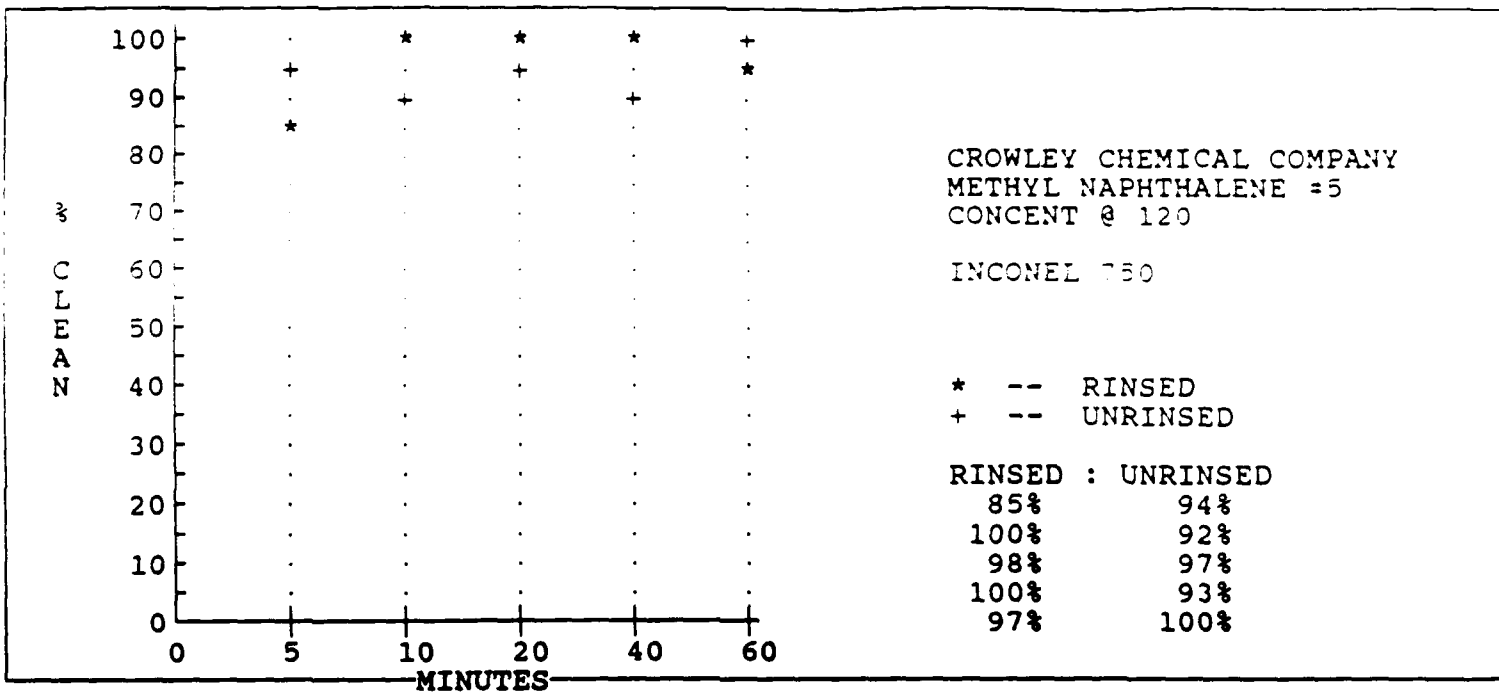


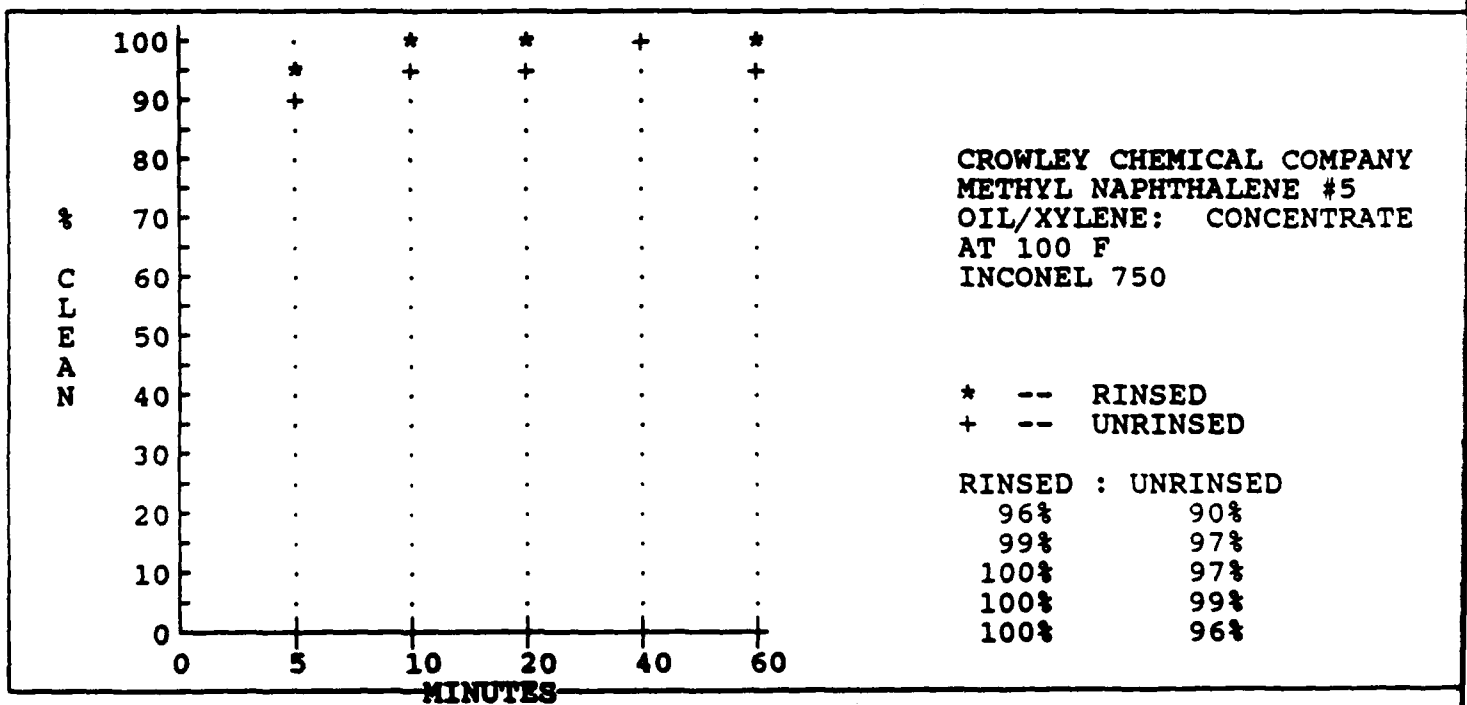
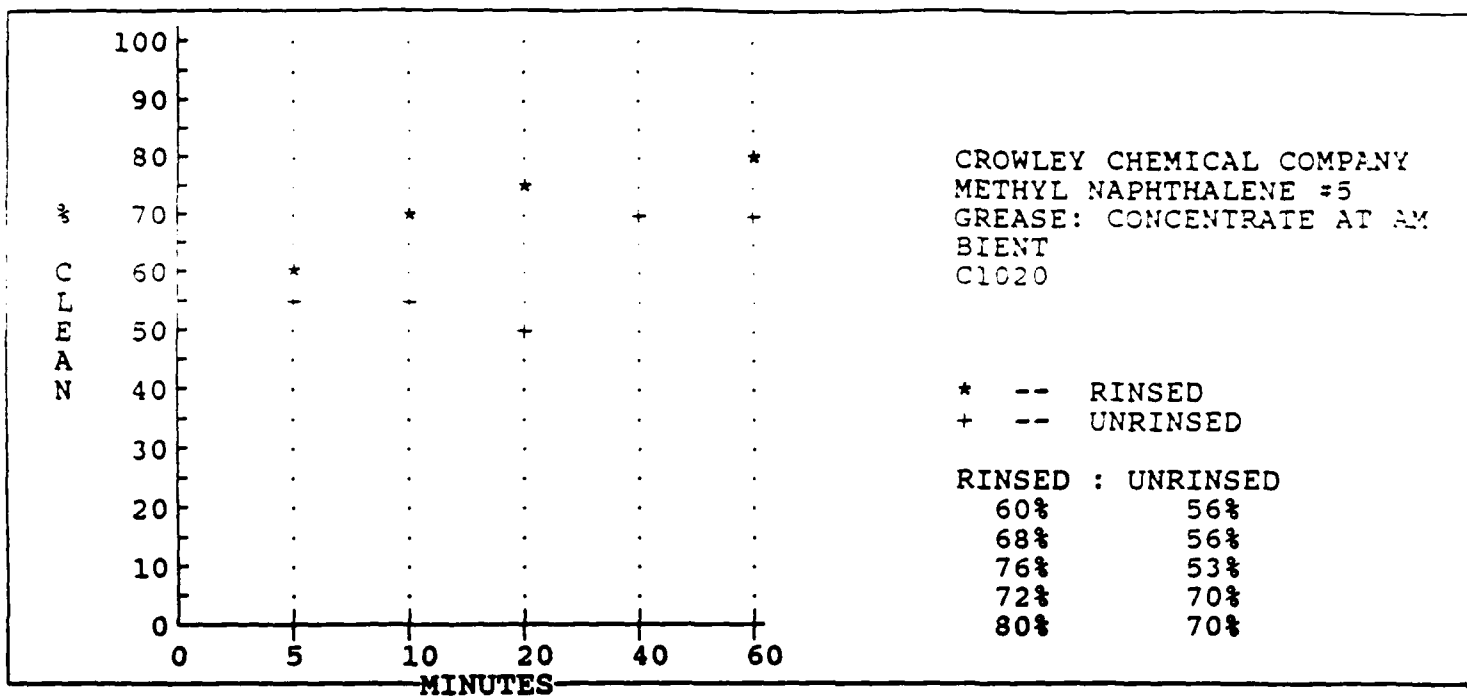


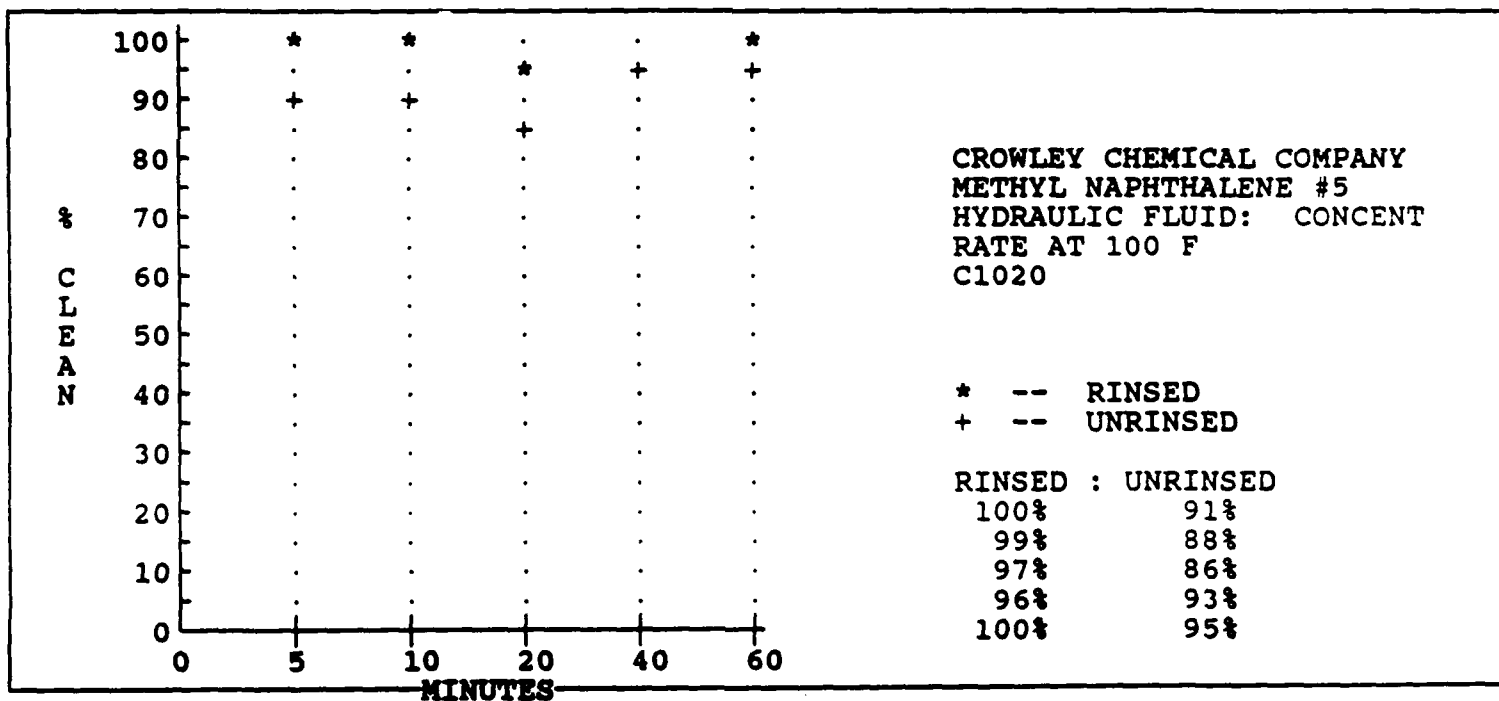
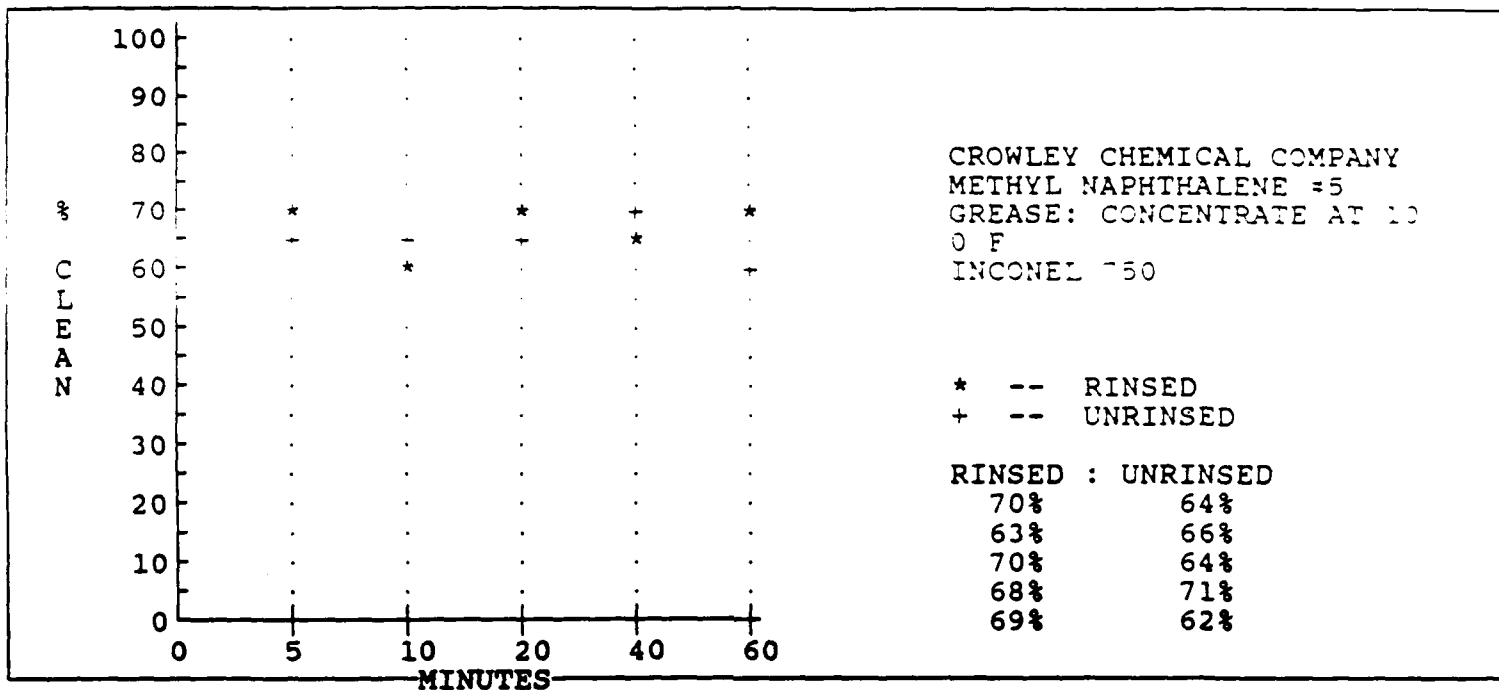
RINSED	UNRINSED
32%	29%
41%	29%
46%	37%
43%	54%
56%	46%

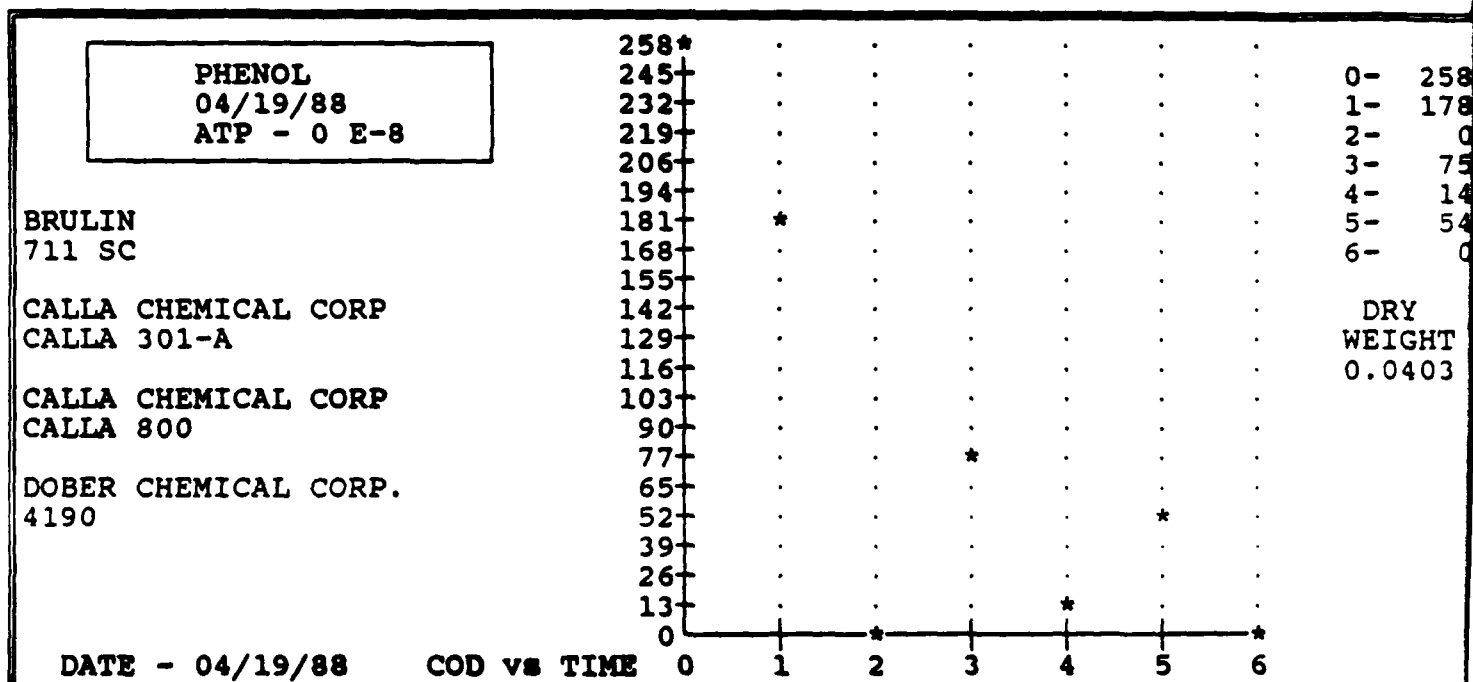
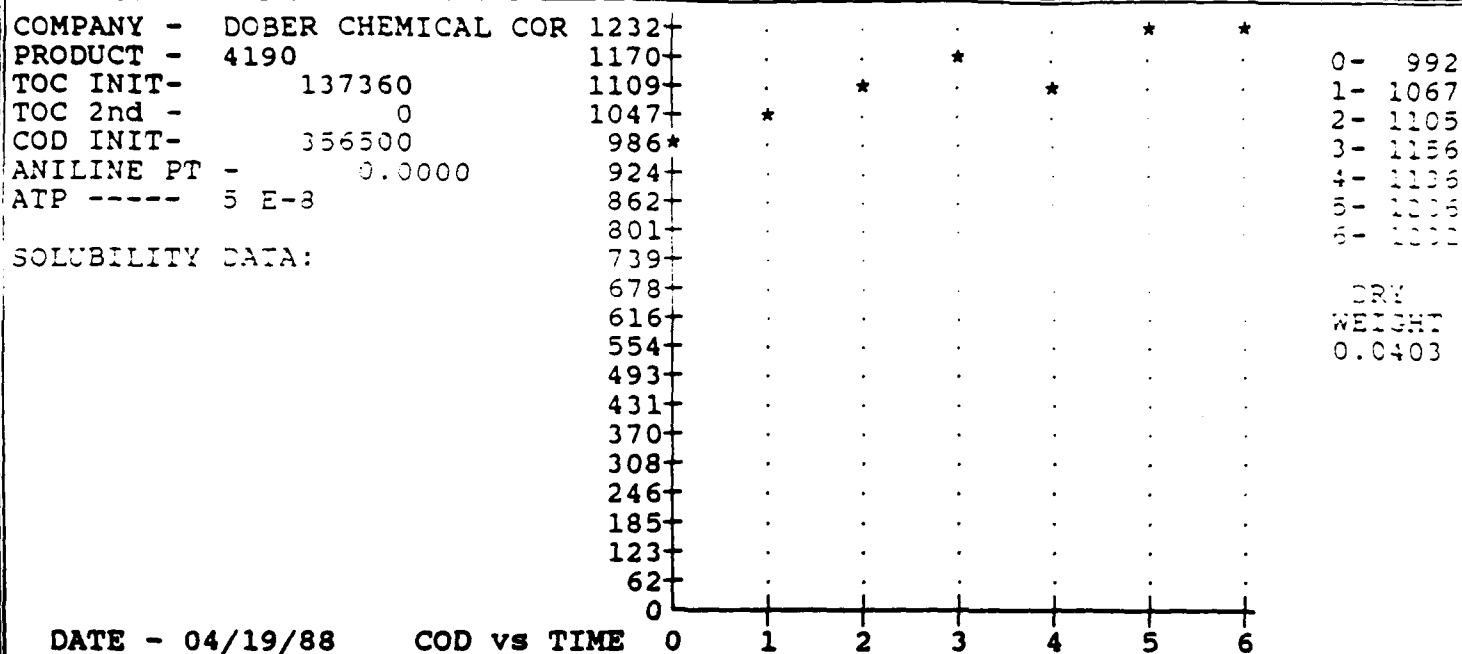


RINSED	UNRINSED
68%	61%
78%	69%
83%	76%
88%	86%
90%	79%









COMPANY - DOBER CHEMICAL COR	1317	.	.	.	.	.	*
PRODUCT - 4190	1251	.	.	.	.	.	.	0- 1050
TOC INIT- 137360	1185	.	.	.	.	*	.	1- 1082
TOC 2nd - 0	1119	.	*	*	*	.	.	2- 1114
COD INIT- 356500	1054	*	.	.	.	.	.	3- 1141
ANILINE PT - 0.0000	988	.	.	.	.	.	.	4- 1145

SOLUBILITY DATA:

922	.	.	.	.	.	.	.	5- 1196
856	.	.	.	.	.	.	.	6- 1217
790	.	.	.	.	.	.	.
724	.	.	.	.	.	.	.
659	.	.	.	.	.	.	.	DRY
593	.	.	.	.	.	.	.	WEIGHT
527	.	.	.	.	.	.	.	0.0611
461	.	.	.	.	.	.	.
395	.	.	.	.	.	.	.
329	.	.	.	.	.	.	.
263	.	.	.	.	.	.	.
198	.	.	.	.	.	.	.
132	.	.	.	.	.	.	.
66	.	.	.	.	.	.	.
0	.	.	.	.	.	.	.

DATE - 05/05/88 COD vs TIME 0 1 2 3 4 5 6

PHENOL
05/05/88
ATP - 0 E-8

BRULIN
711 SC

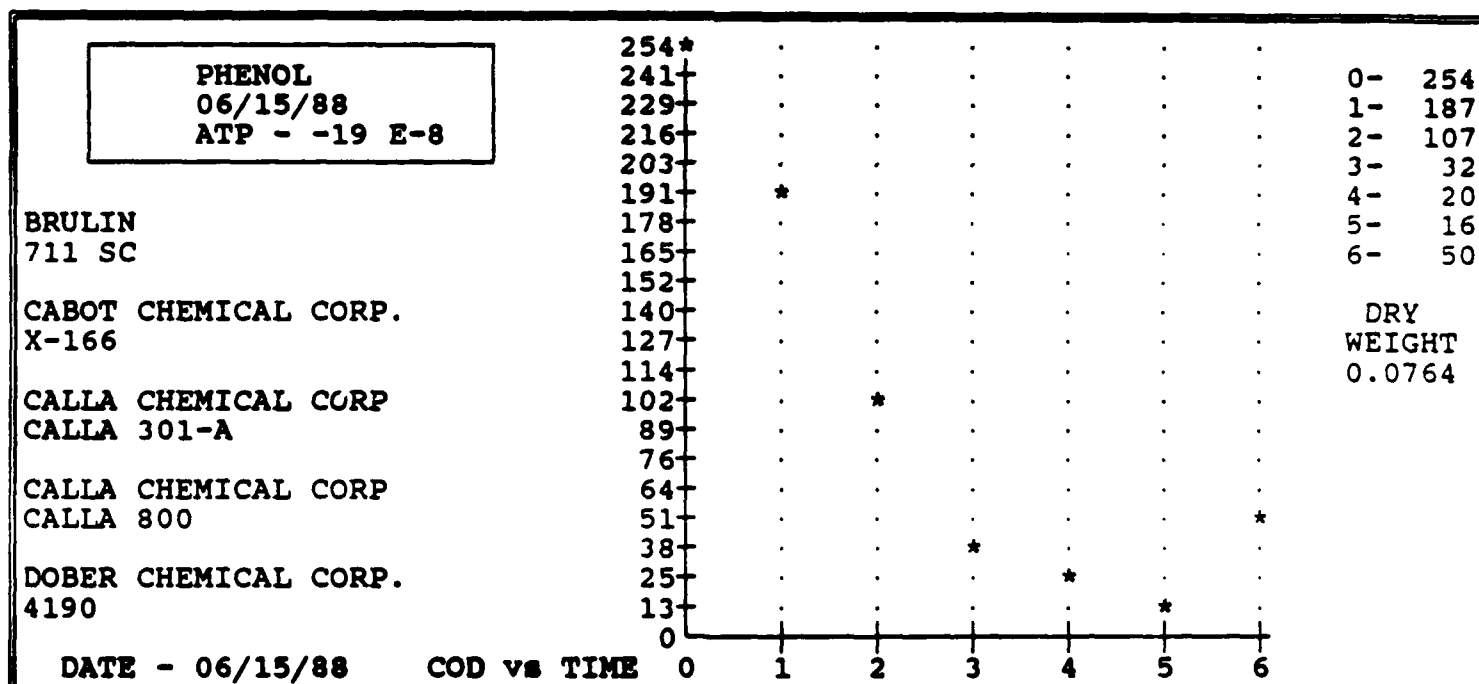
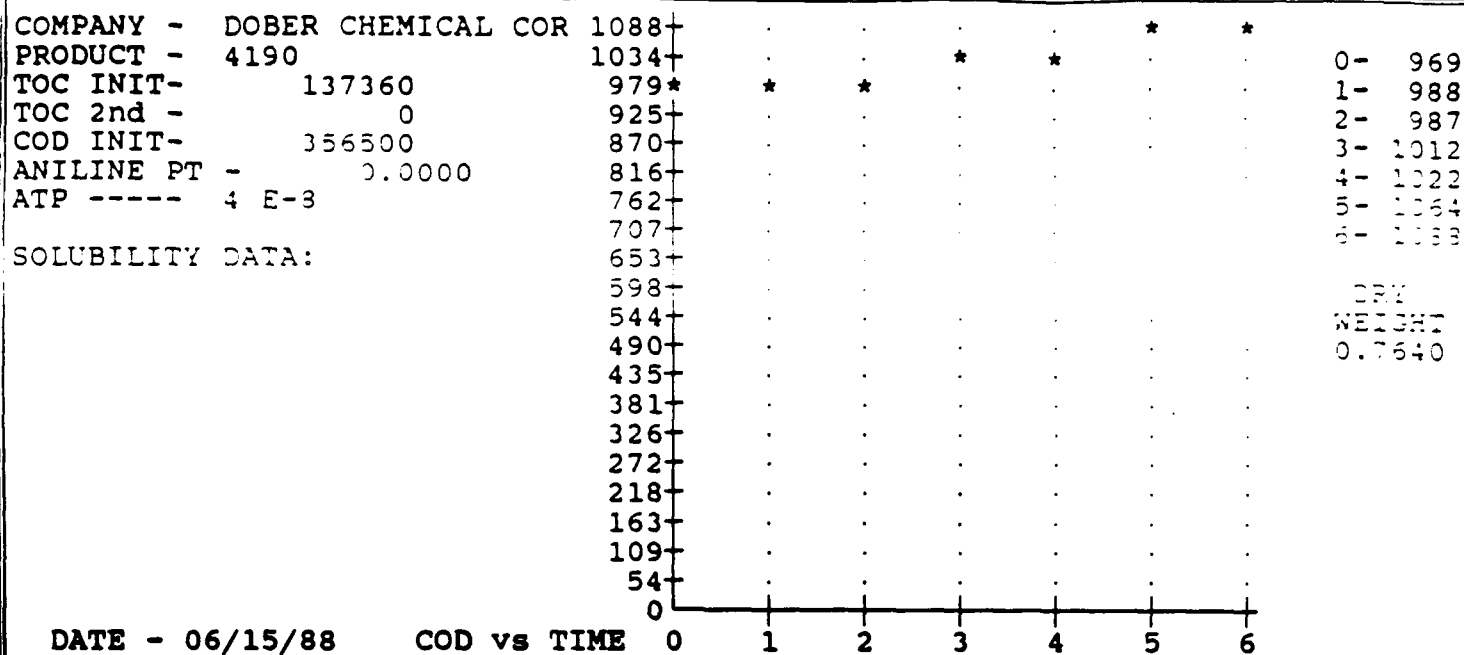
CALLA CHEMICAL CORP
CALLA 301-A

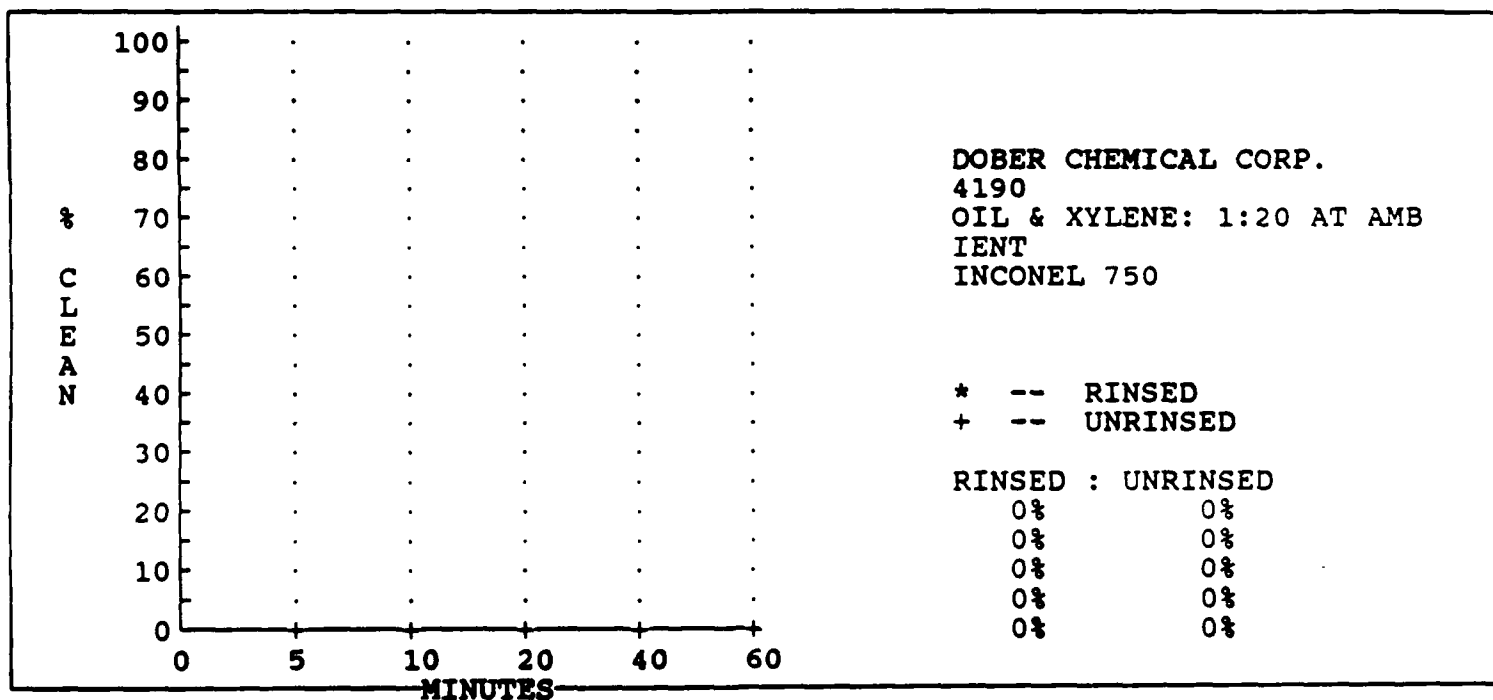
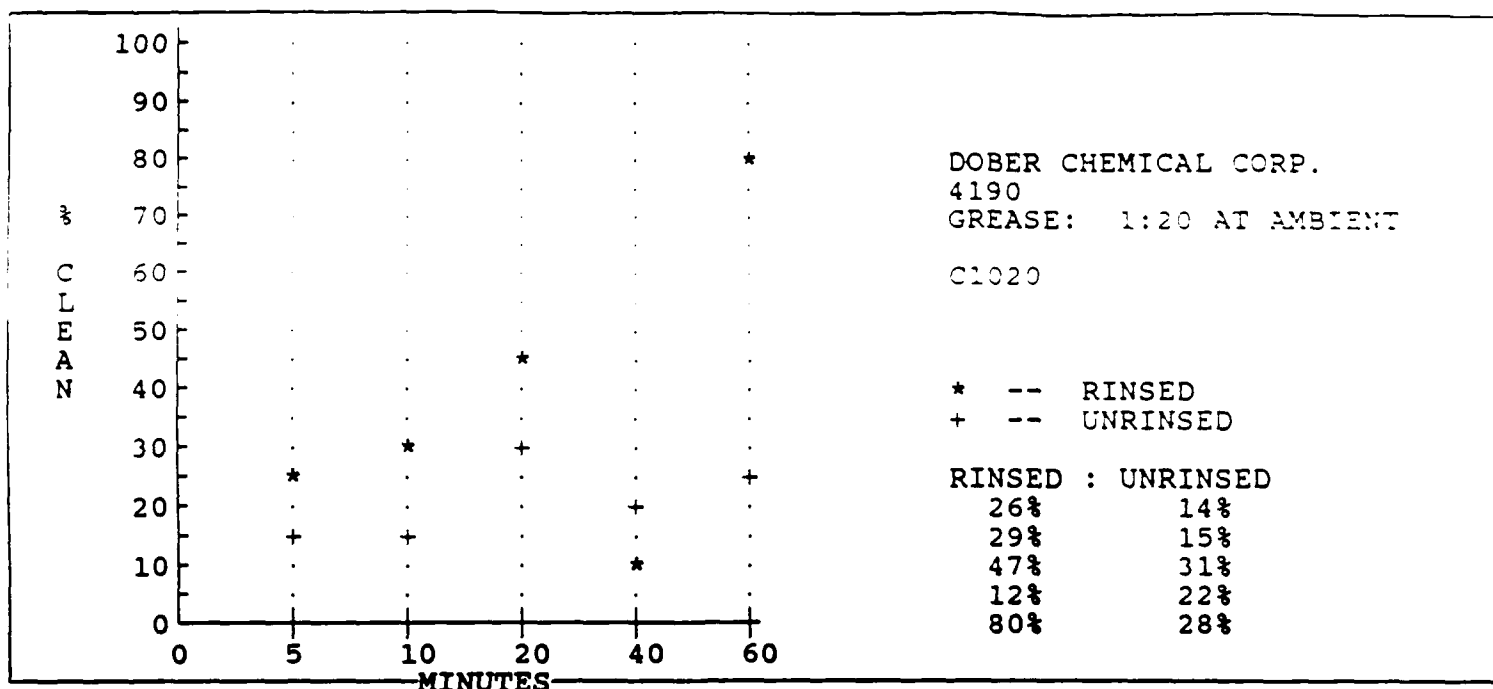
CALLA CHEMICAL CORP
CALLA 800

DOBER CHEMICAL CORP.
4190

394	.	.	.	.	.	.	*
374	.	.	.	.	.	.	.	0- 284
355	.	.	.	.	*	.	.	1- 308
335	.	.	*	.	.	.	.	2- 305
315	*	.	.	*	.	.	.	3- 326
296	.	*	.	.	.	.	.	4- 322
276	.	.	.	.	.	.	.	5- 363
256	.	.	.	.	.	.	.	6- 394
236	.	.	.	.	.	.	.
217	.	.	.	.	.	.	.	DRY
197	.	.	.	.	.	.	.	WEIGHT
177	.	.	.	.	.	.	.	0.0611
158	.	.	.	.	.	.	.
138	.	.	.	.	.	.	.
118	.	.	.	.	.	.	.
99	.	.	.	.	.	.	.
79	.	.	.	.	.	.	.
59	.	.	.	.	.	.	.
39	.	.	.	.	.	.	.
20	.	.	.	.	.	.	.
0	.	.	.	.	.	.	.

DATE - 05/05/88 COD vs TIME 0 1 2 3 4 5 6





COMPANY - DOBER CHEMICAL COR
 PRODUCT - 8679
 TOC INIT- 50300
 TOC 2nd - 0
 COD INIT- 48000
 ANILINE PT - 0.0000
 ATP ----- -35 E-3

SOLUBILITY DATA:

4 OZ/GA @ 200 11%
 16 OZ/G @ 120 0%

142*
 135+
 128+
 121+
 114+
 107+
 99+
 92+
 85+
 78+
 71+
 64+
 57+
 50+
 43+
 36+
 28+
 21+
 14+
 7+
 0

0- 142
 1- 14
 2- 79
 3- 44
 4- 12
 5- 7
 6- 0

DRY
 WEIGHT
 0.0594

DATE - 03/16/88

COD vs TIME

0 1 2 3 4 5 6

PHENOL
 03/16/88
 ATP - 758 E-8

DOBER CHEMICAL CORP.
 8679

HOMESTEAD INDUSTRIES INC.
 #49

HOMESTEAD INDUSTRIES INC.
 #65

HUNTINGTON
 J8-10P

HYDRITE CHEMICAL CO.
 HYDRI-CLEAN NPX

342*
 325+
 308+
 291+
 274+
 257+
 239+
 222+
 205+
 188+
 171+
 154+
 137+
 120+
 103+
 86+
 68+
 51+
 34+
 17+
 0

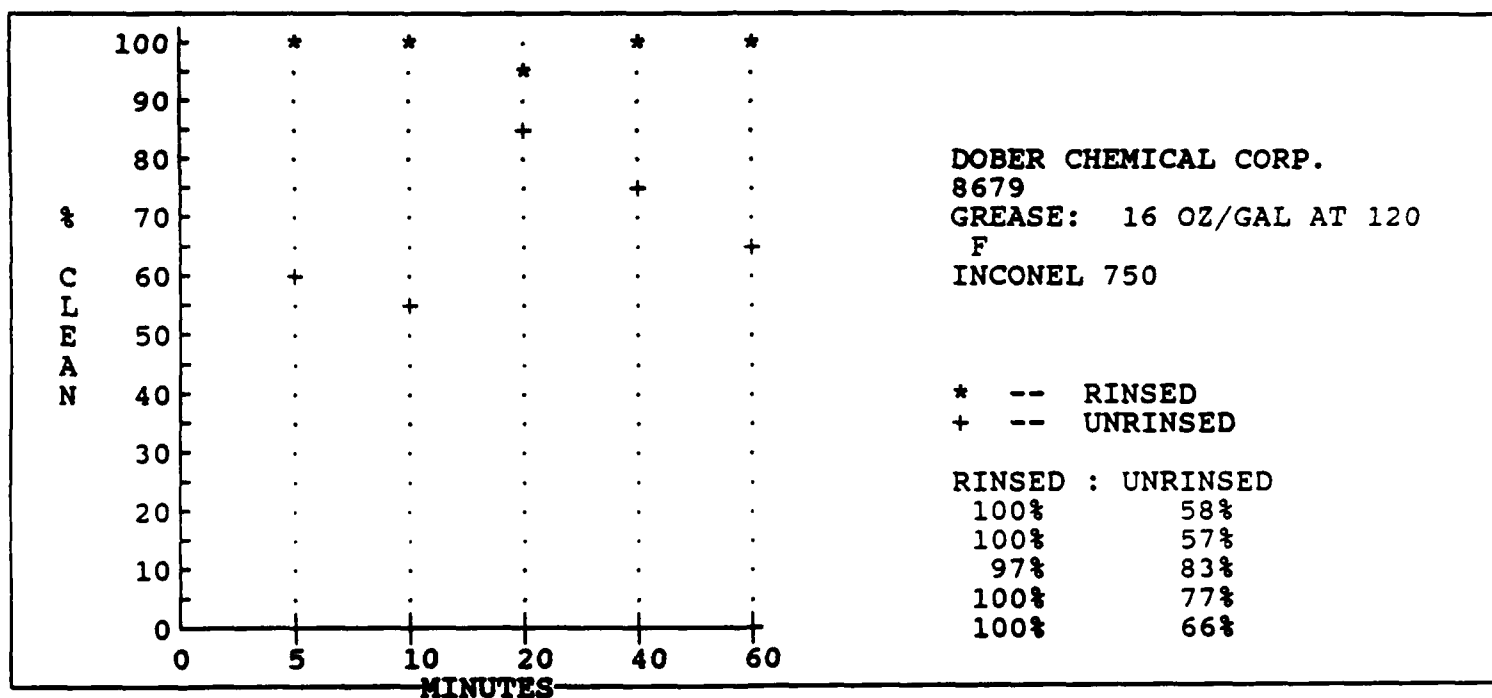
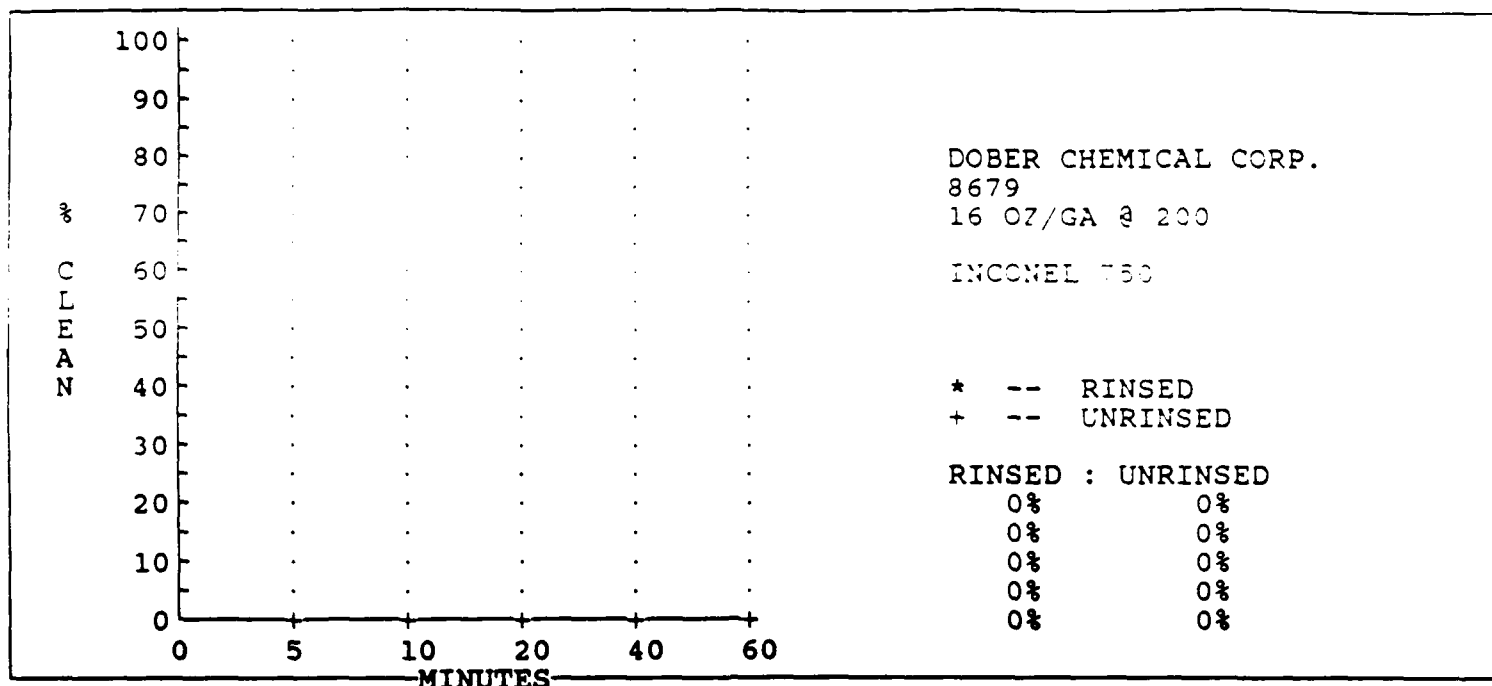
0- 342
 1- 242
 2- 252
 3- 146
 4- 110
 5- 38
 6- 12

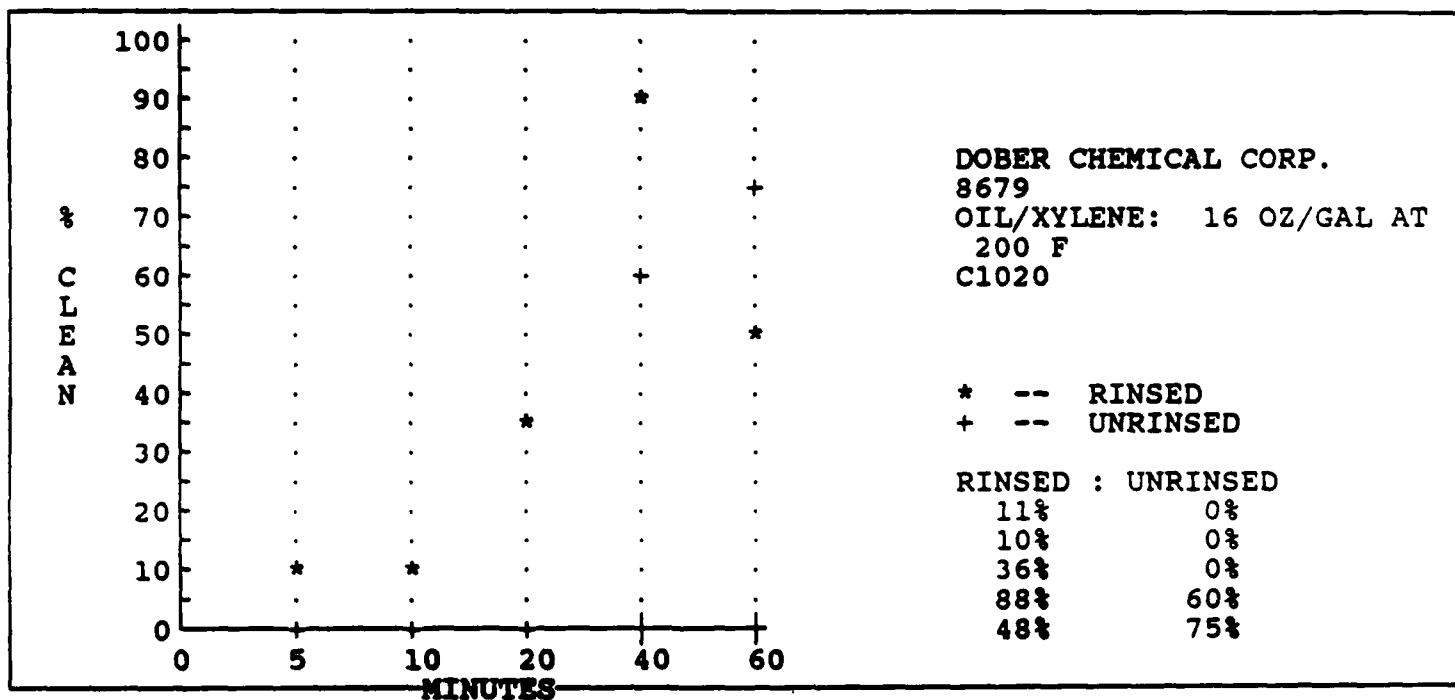
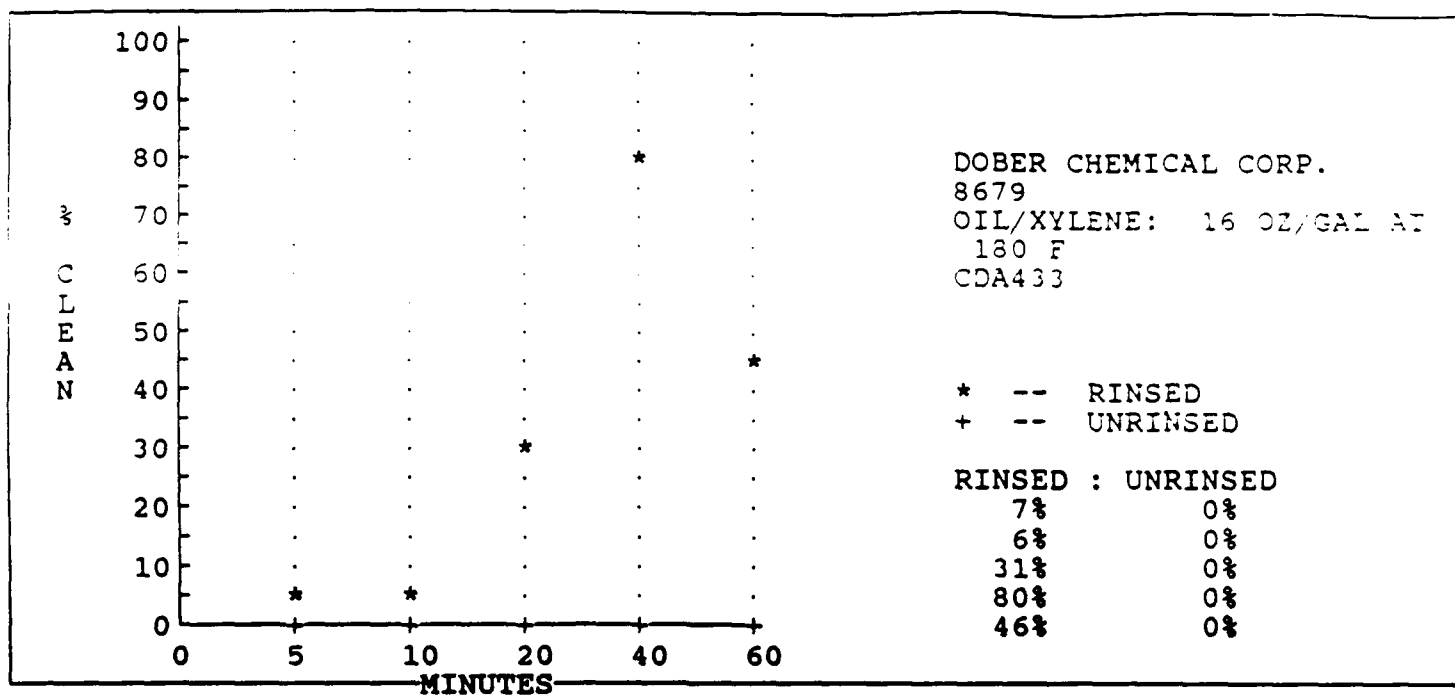
DRY
 WEIGHT
 0.0594

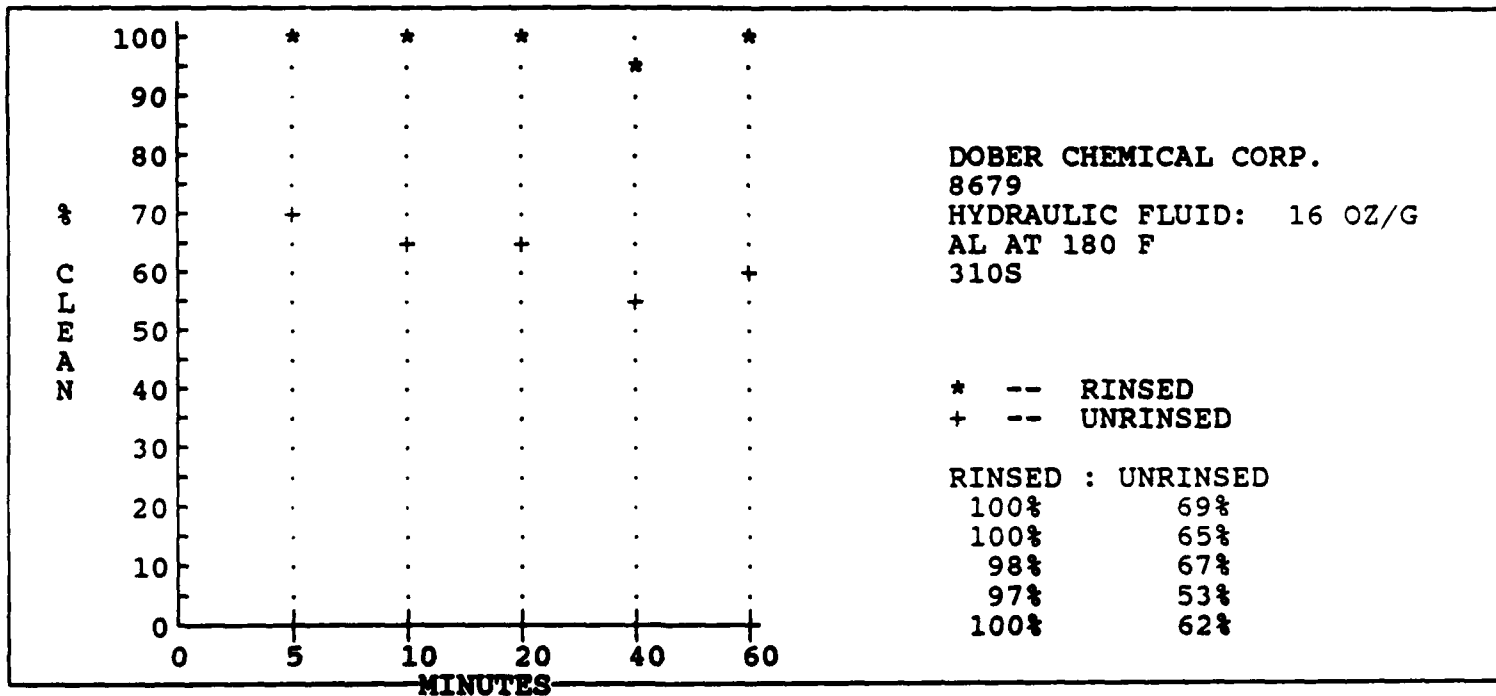
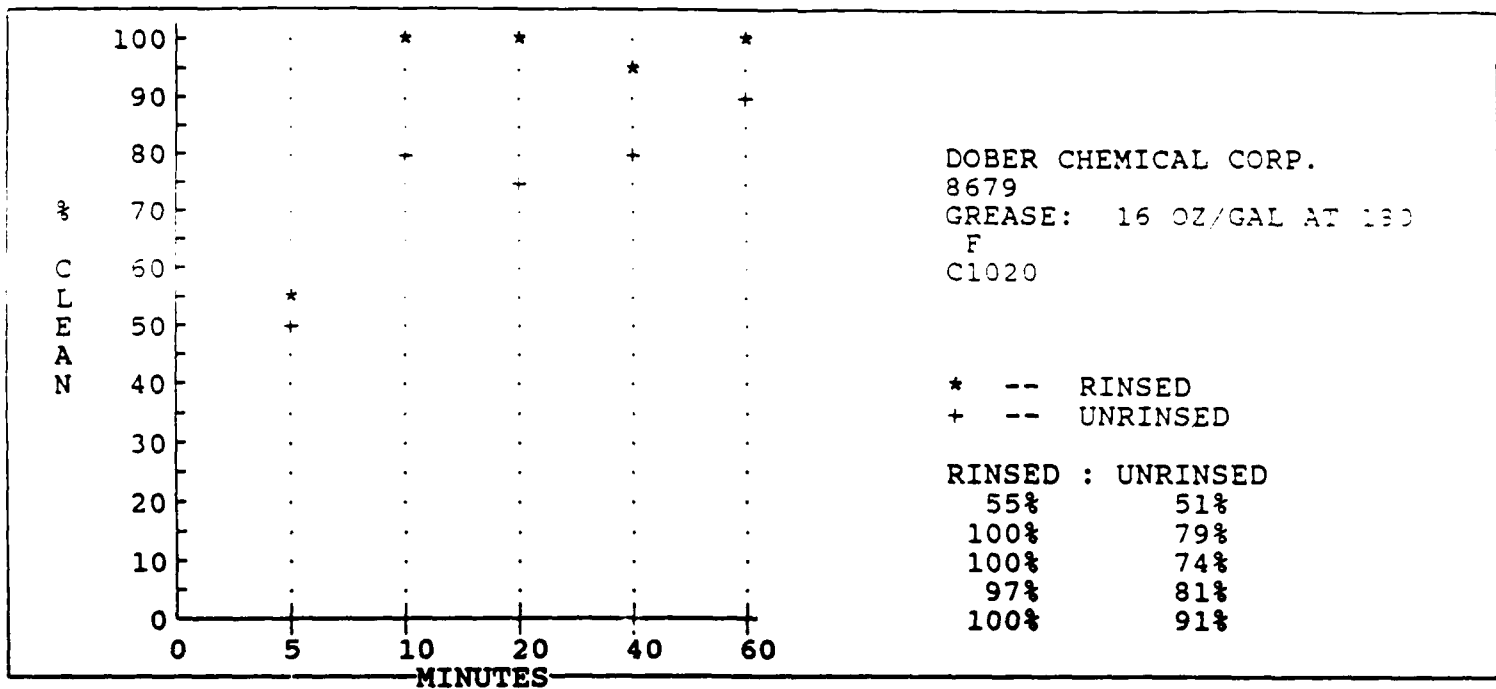
DATE - 03/16/88

COD vs TIME

0 1 2 3 4 5 6

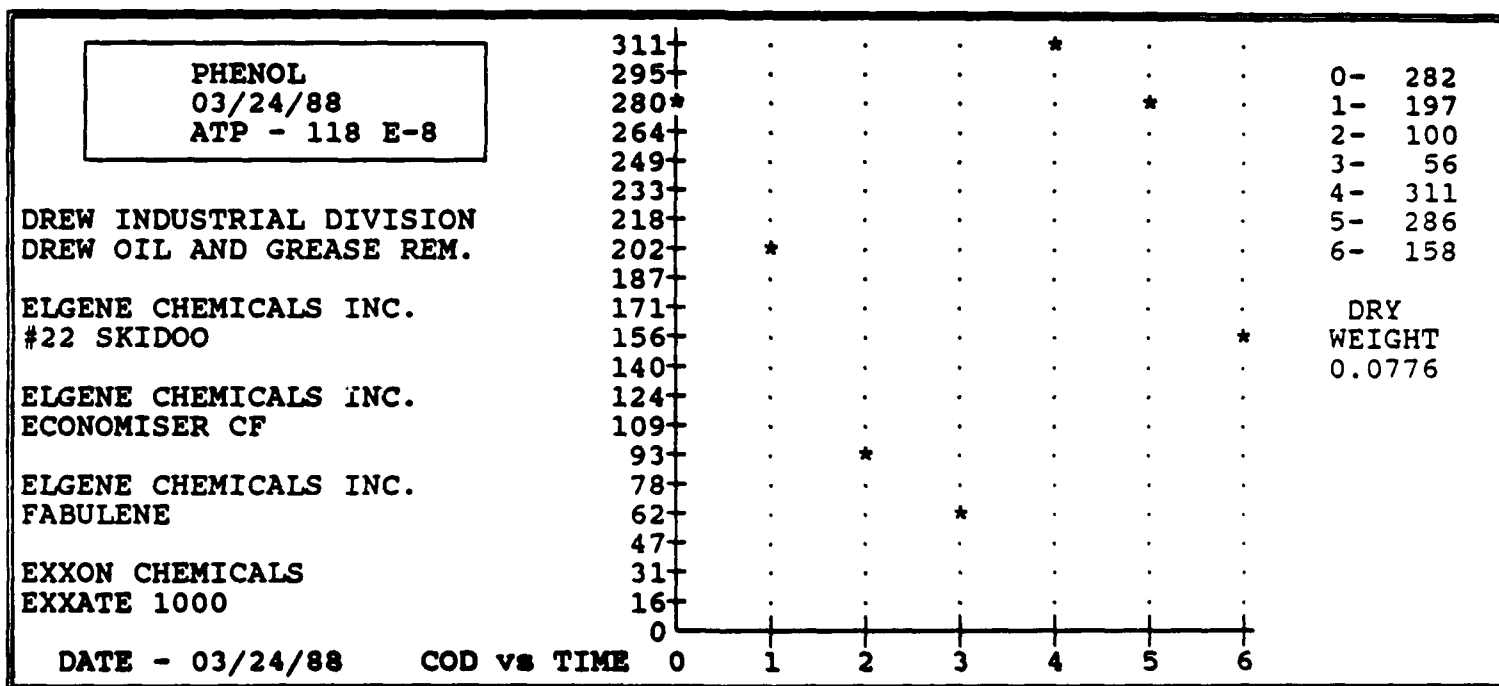
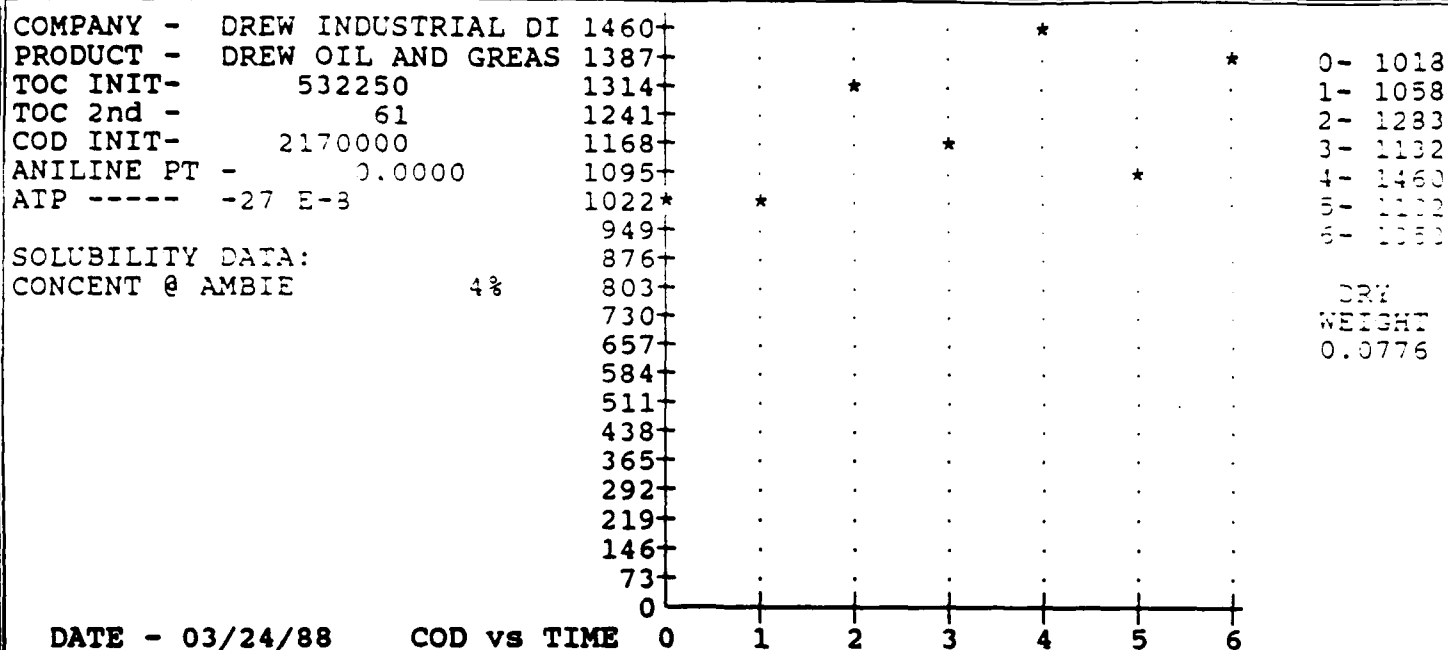


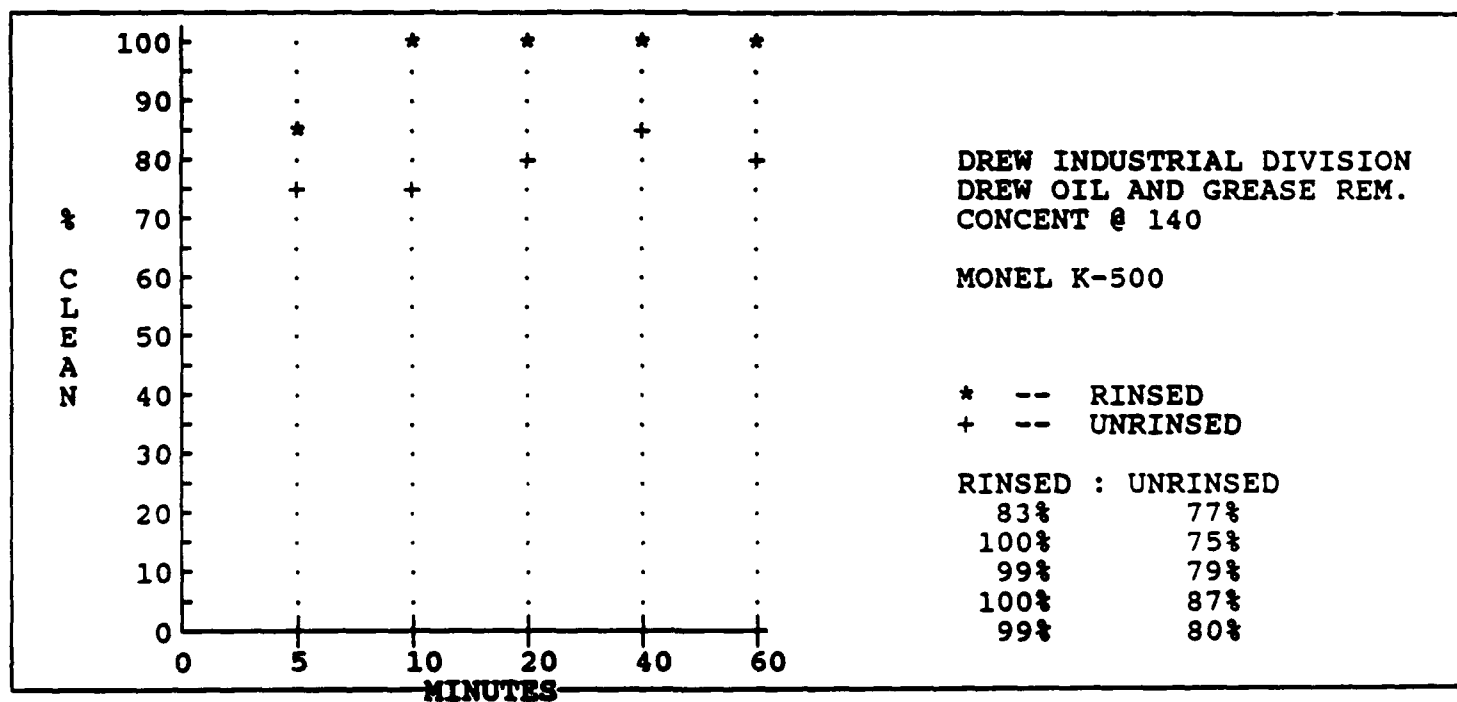
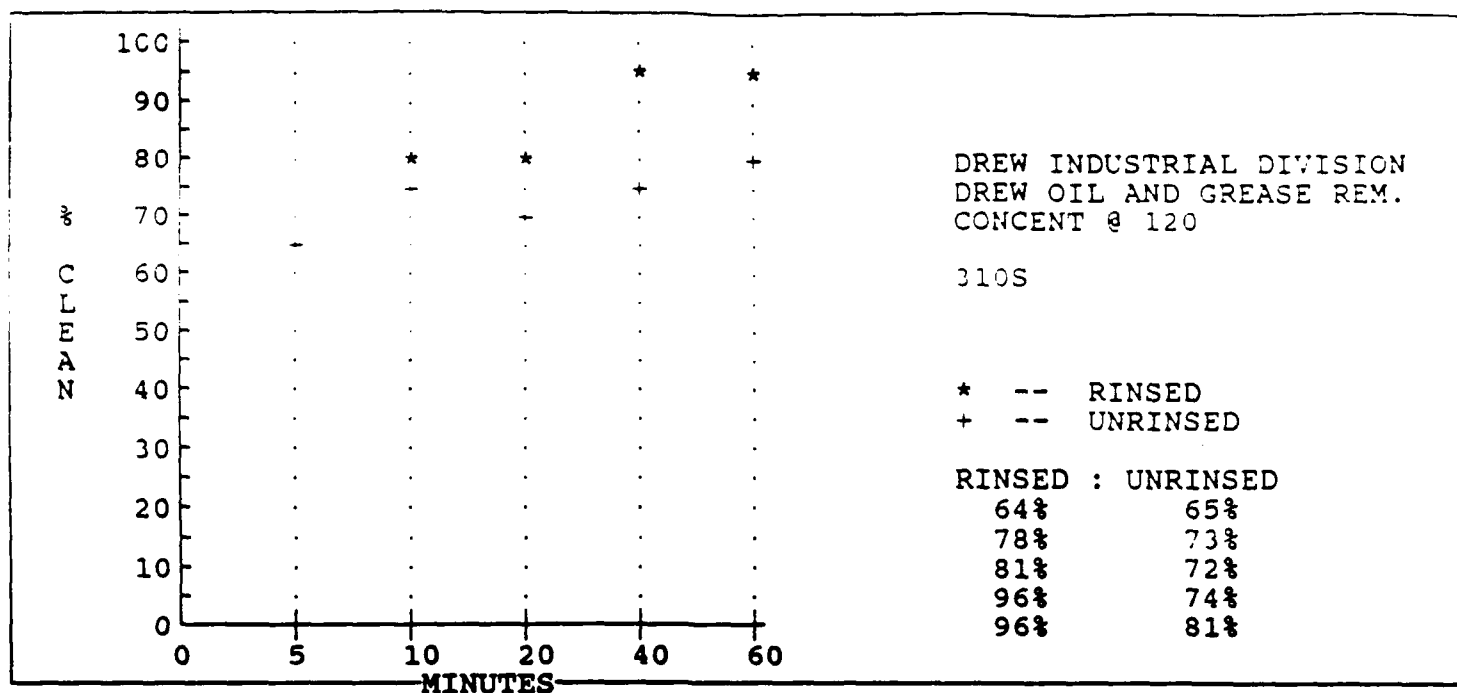


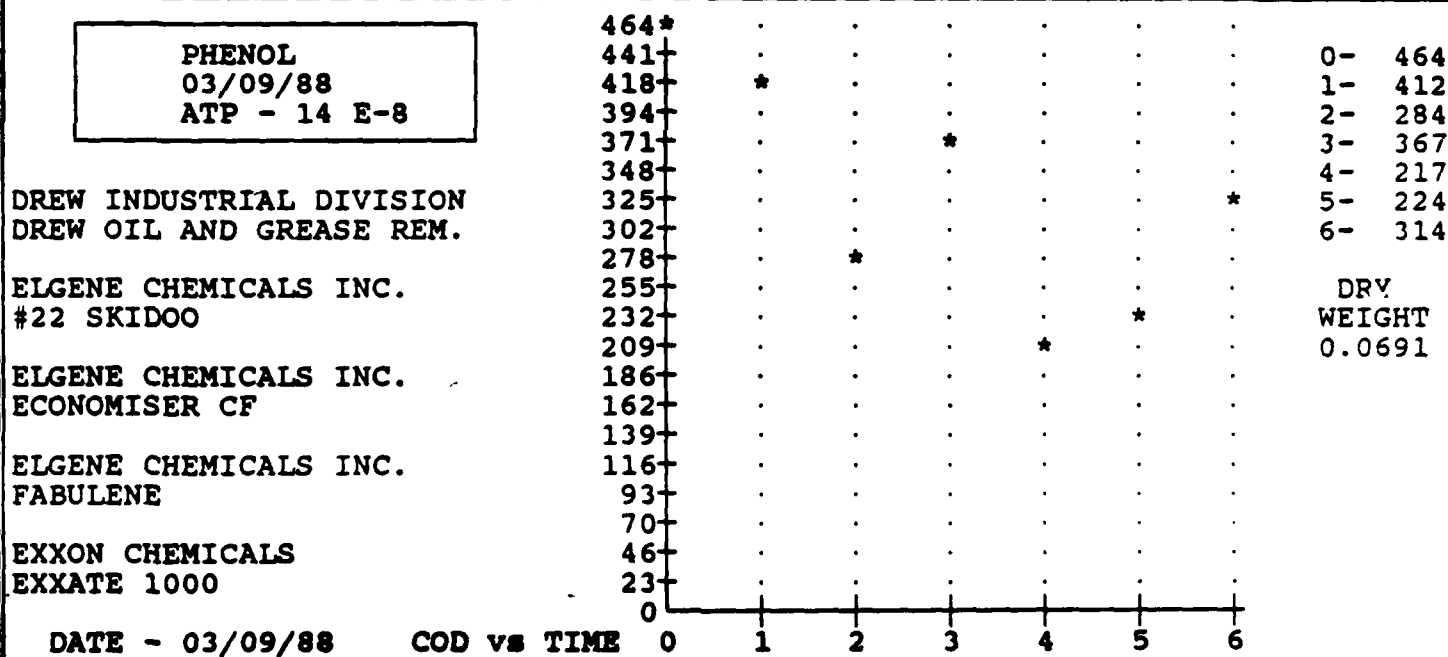
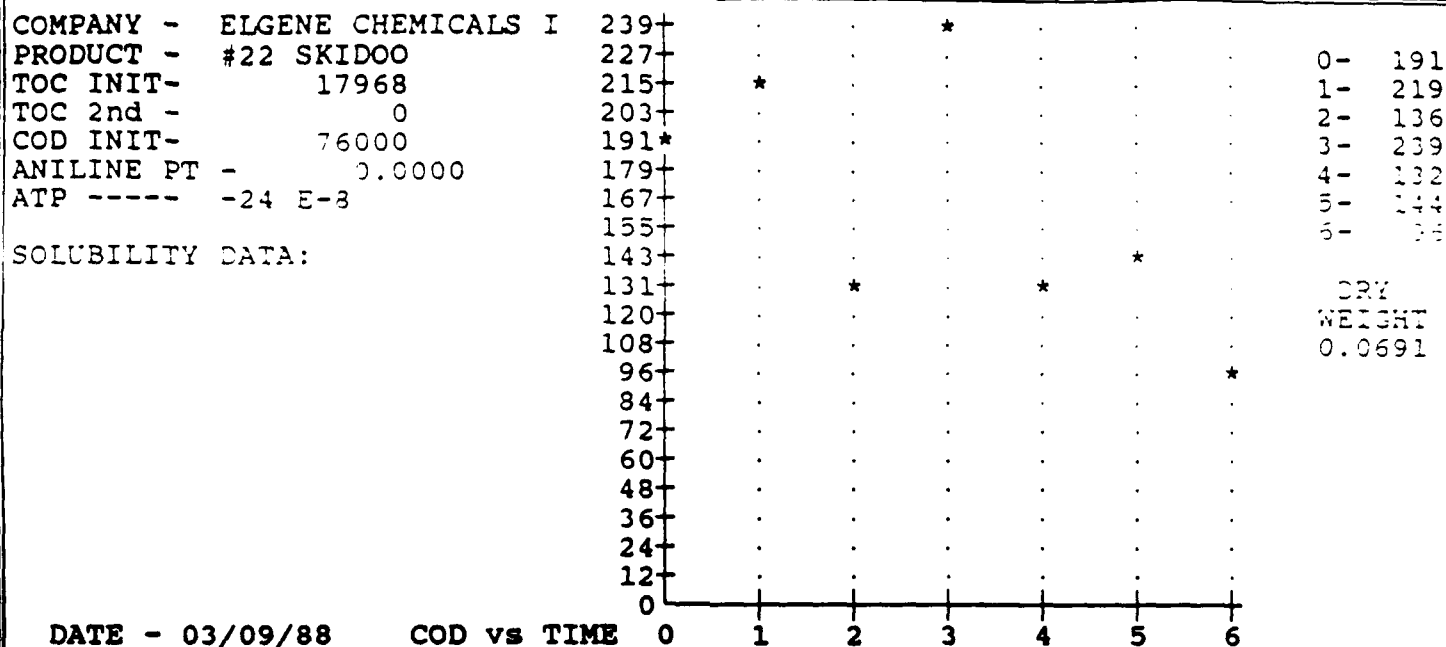


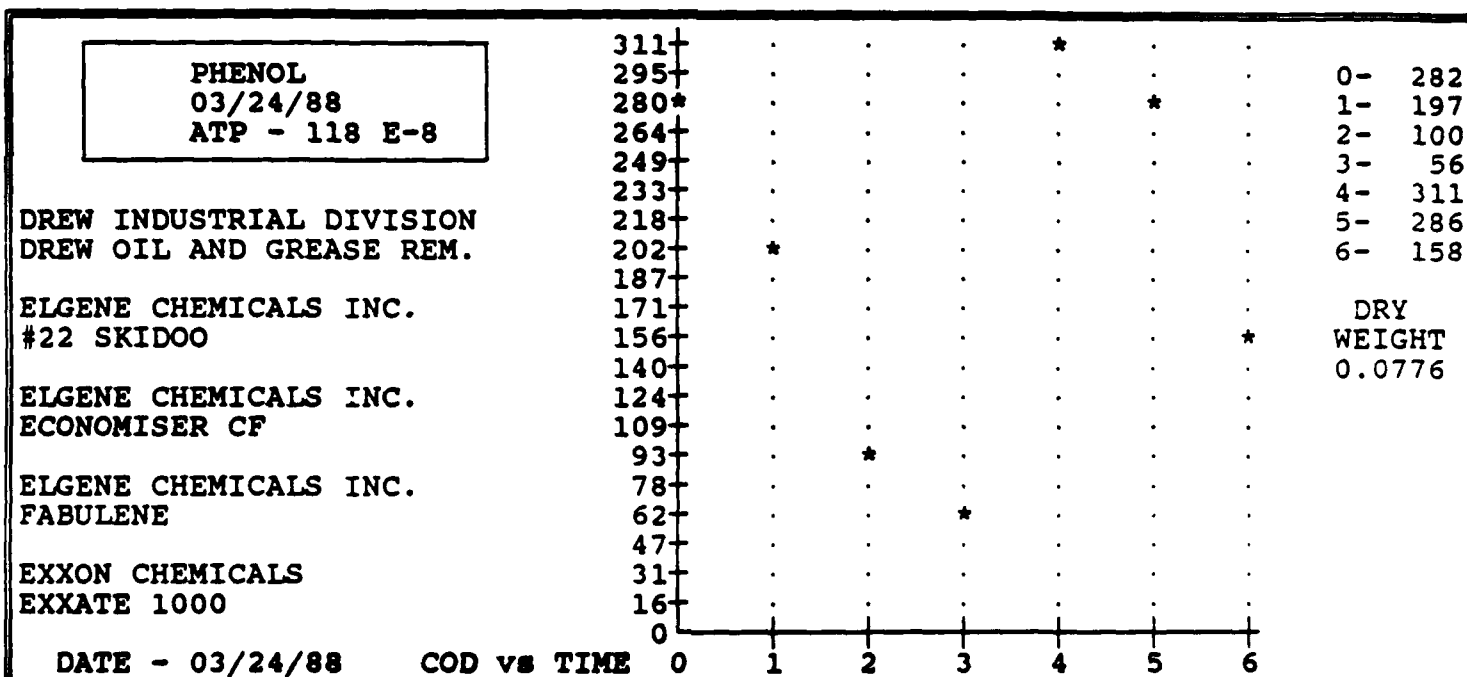
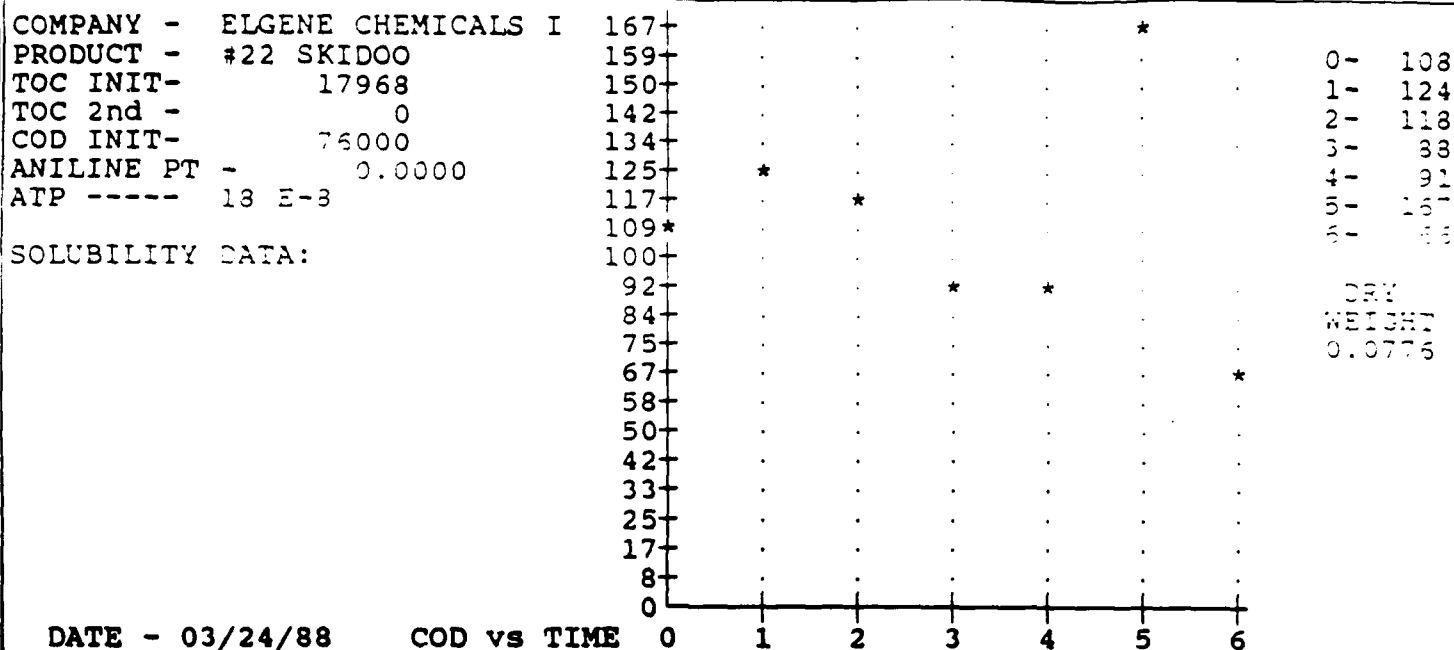
COMPANY - DREW INDUSTRIAL DI	1650	.	.	*	.	*	*	
PRODUCT - DREW OIL AND GREAS	1568	.	.	.	.	.	.	0- 1174
TOC INIT- 532250	1485	.	.	.	.	.	.	1- 1200
TOC 2nd - 61	1403	.	.	.	.	.	.	2- 1312
COD INIT- 2170000	1320	.	*	.	.	.	.	3- 1650
ANILINE PT - 0.0000	1238	*	.	.	*	.	.	4- 1265
ATP ----- -109 E-3	1155*	.	.	.	.	.	.	5- 1650
	1073	.	.	.	.	.	.	6- 1650
SOLUBILITY DATA:	990	.	.	.	.	.	.
CONCENT @ AMBIE 4 3/4	908	.	.	.	.	.	.	DRY
	825	.	.	.	.	.	.	WEIGHT
	743	.	.	.	.	.	.	0.0691
	660	.	.	.	.	.	.
	578	.	.	.	.	.	.
	495	.	.	.	.	.	.
	413	.	.	.	.	.	.
	330	.	.	.	.	.	.
	248	.	.	.	.	.	.
	165	.	.	.	.	.	.
	83	.	.	.	.	.	.
	0	.	.	.	.	.	.
DATE - 03/09/88	COD vs TIME	0	1	2	3	4	5	6

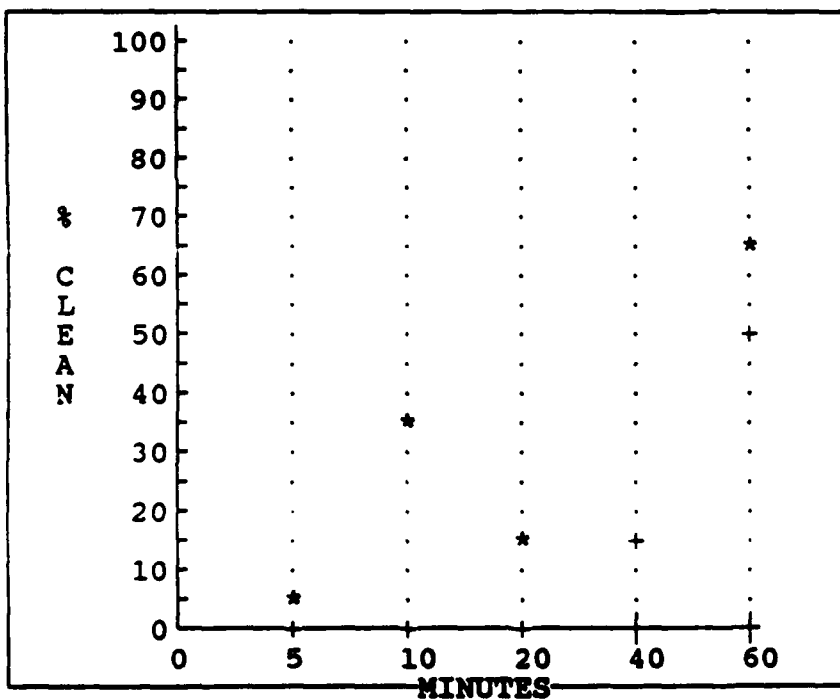
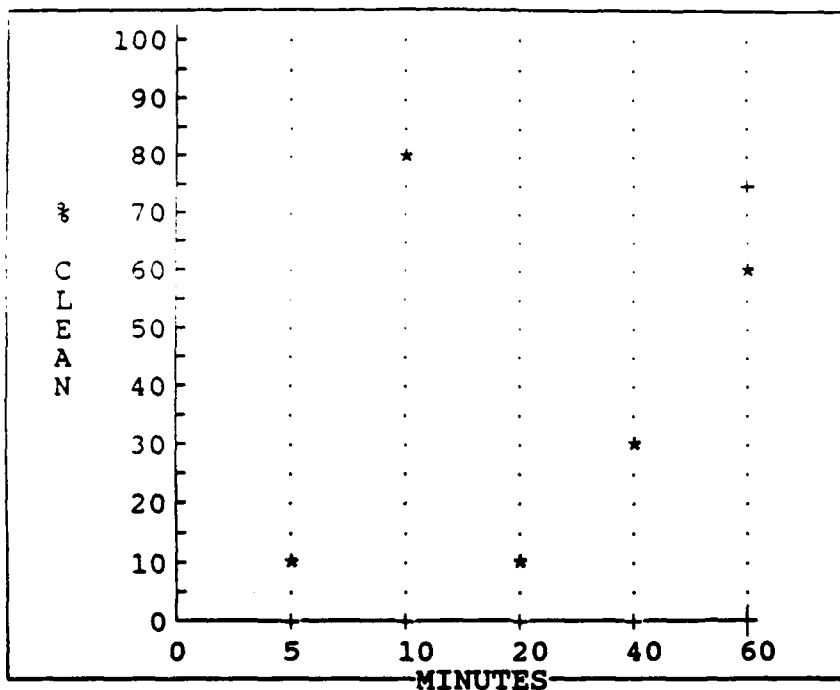
PHENOL	464*	.	.	.	.	.	.	0- 464
03/09/88	441	.	.	.	.	.	.	1- 412
ATP - 14 E-8	418	*	.	.	.	.	.	2- 284
	394	.	.	.	.	.	.	3- 367
	371	.	.	*	.	.	.	4- 217
	348	.	.	.	.	.	*	5- 224
DREW INDUSTRIAL DIVISION	325	.	.	.	.	.	.	6- 314
DREW OIL AND GREASE REM.	302	.	.	.	.	.	.
	278	.	*	.	.	.	.
ELGENE CHEMICALS INC.	255	.	.	.	.	.	.	DRY
#22 SKIDOO	232	.	.	.	.	*	.	WEIGHT
	209	.	.	.	*	.	.	0.0691
ELGENE CHEMICALS INC.	186	.	.	.	.	.	.
ECONOMISER CF	162	.	.	.	.	.	.
	139	.	.	.	.	.	.
ELGENE CHEMICALS INC.	116	.	.	.	.	.	.
FABULENE	93	.	.	.	.	.	.
	70	.	.	.	.	.	.
EXXON CHEMICALS	46	.	.	.	.	.	.
EXXATE 1000	23	.	.	.	.	.	.
	0	.	.	.	.	.	.
DATE - 03/09/88	COD vs TIME	0	1	2	3	4	5	6

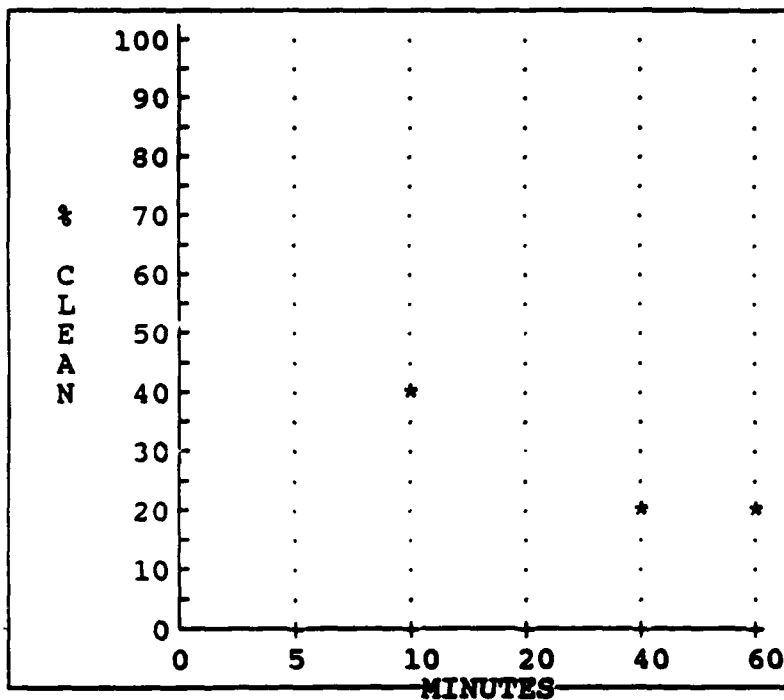
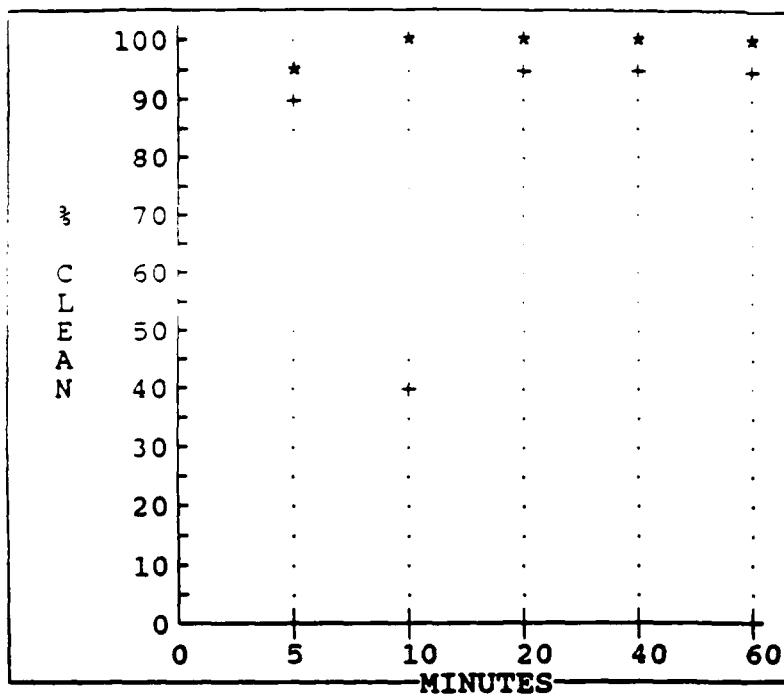


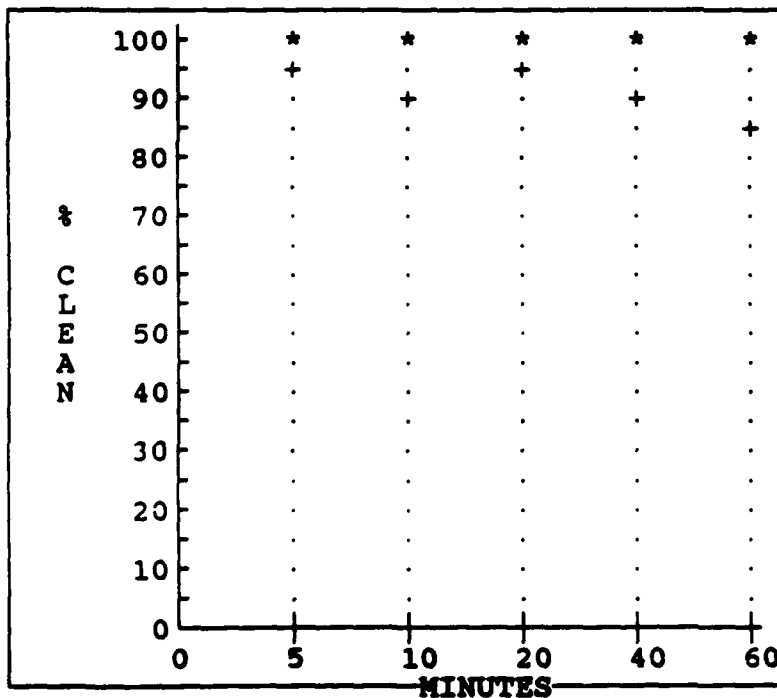
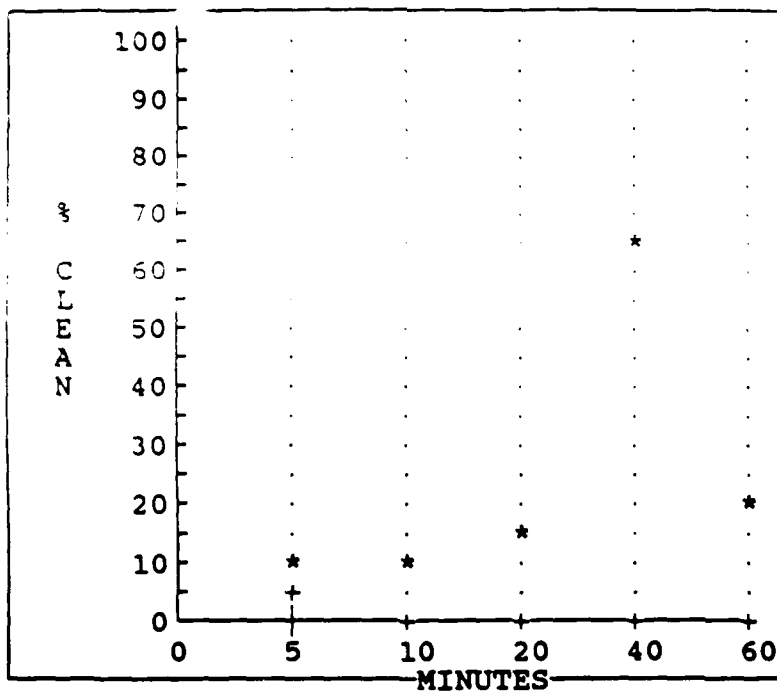


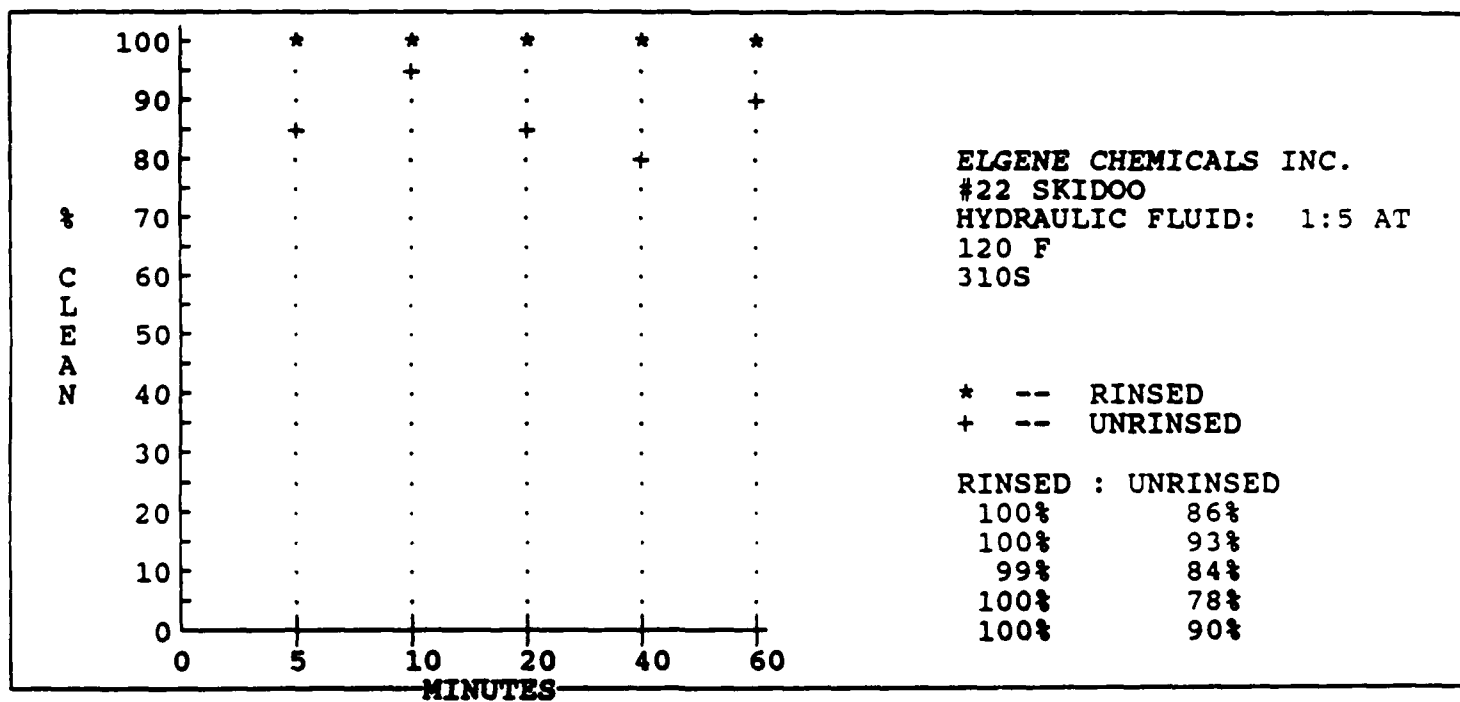
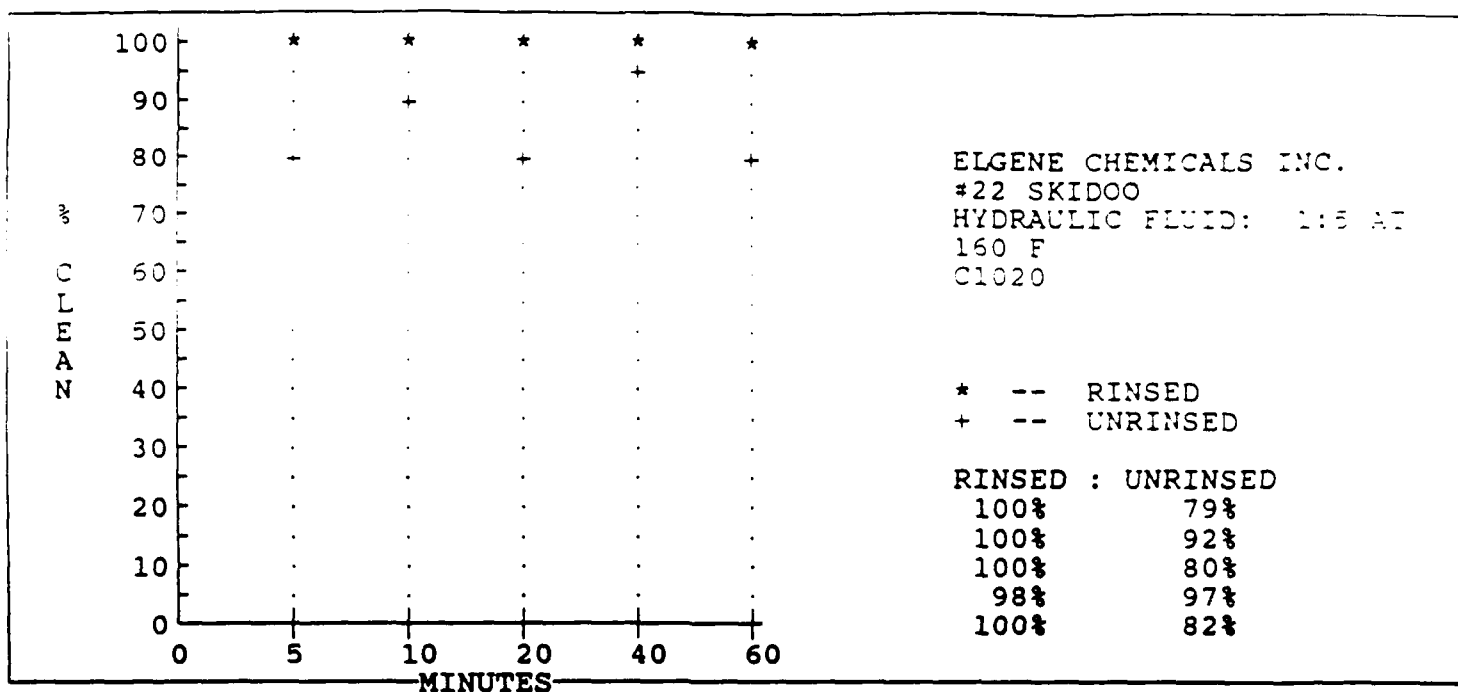


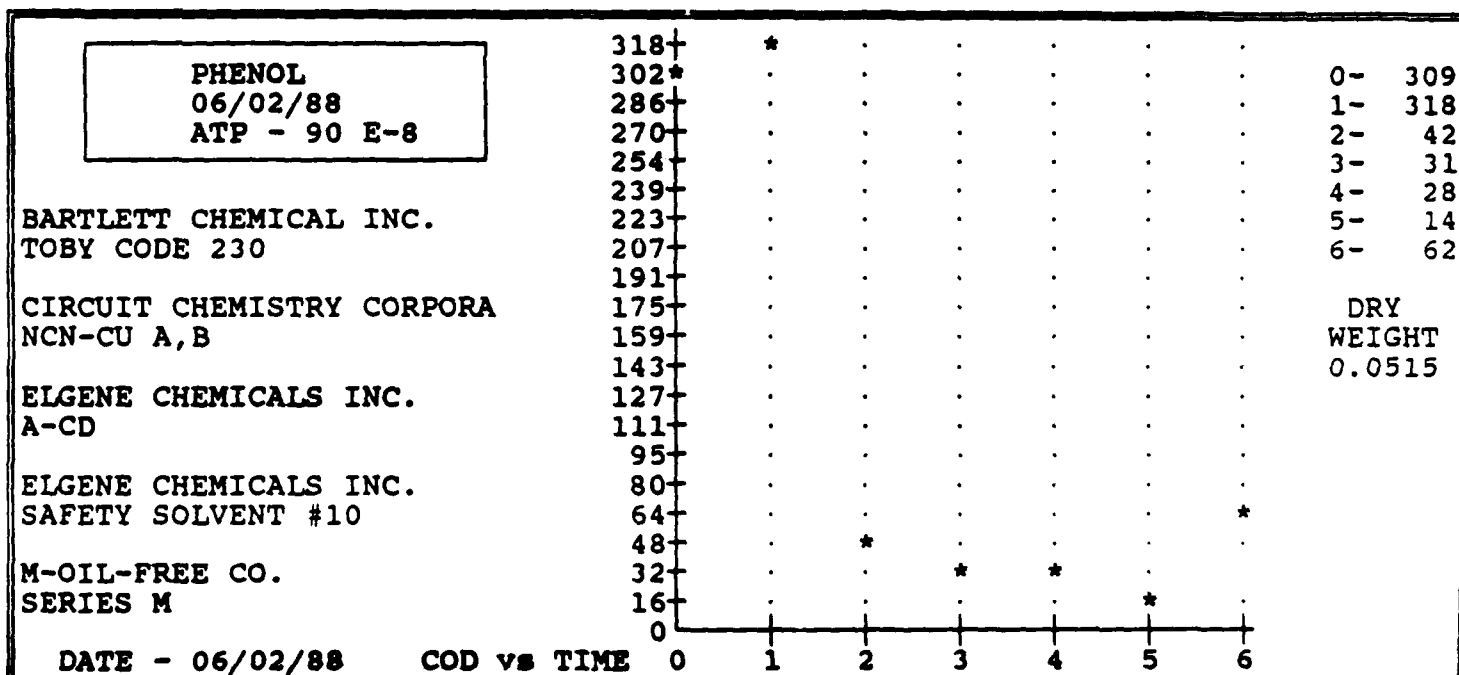
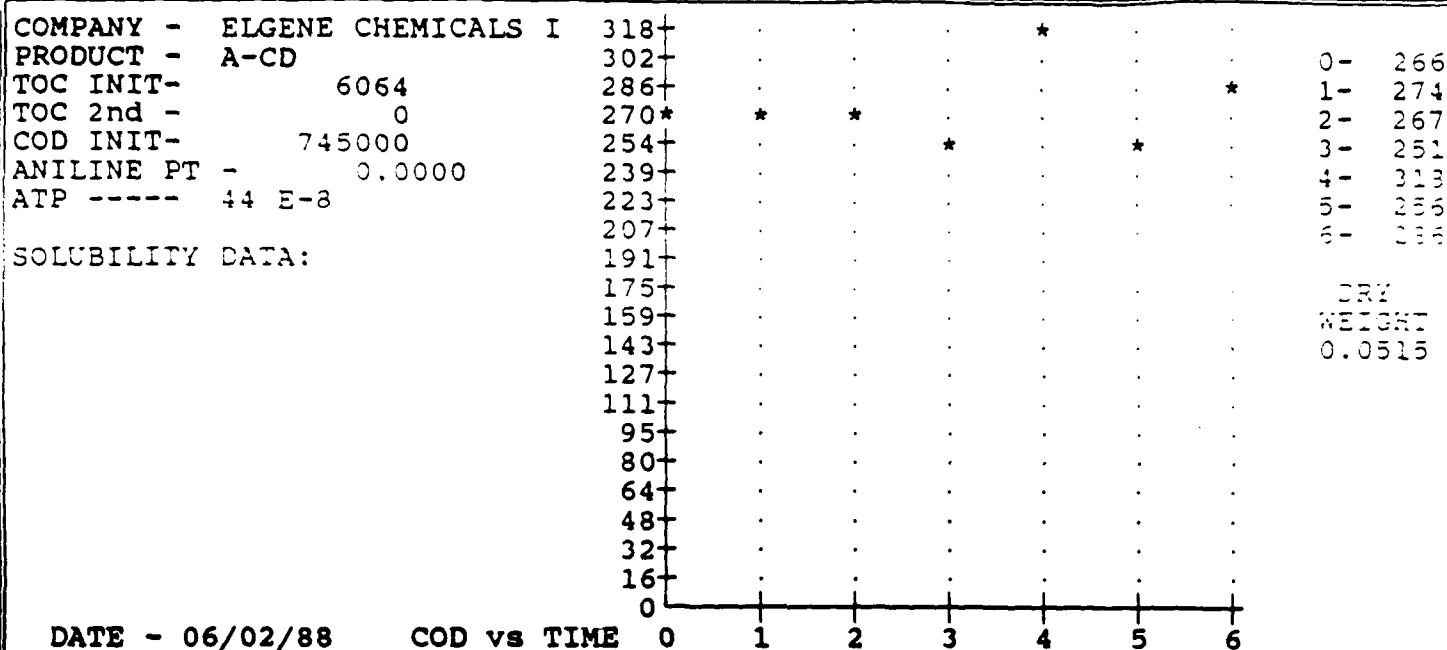


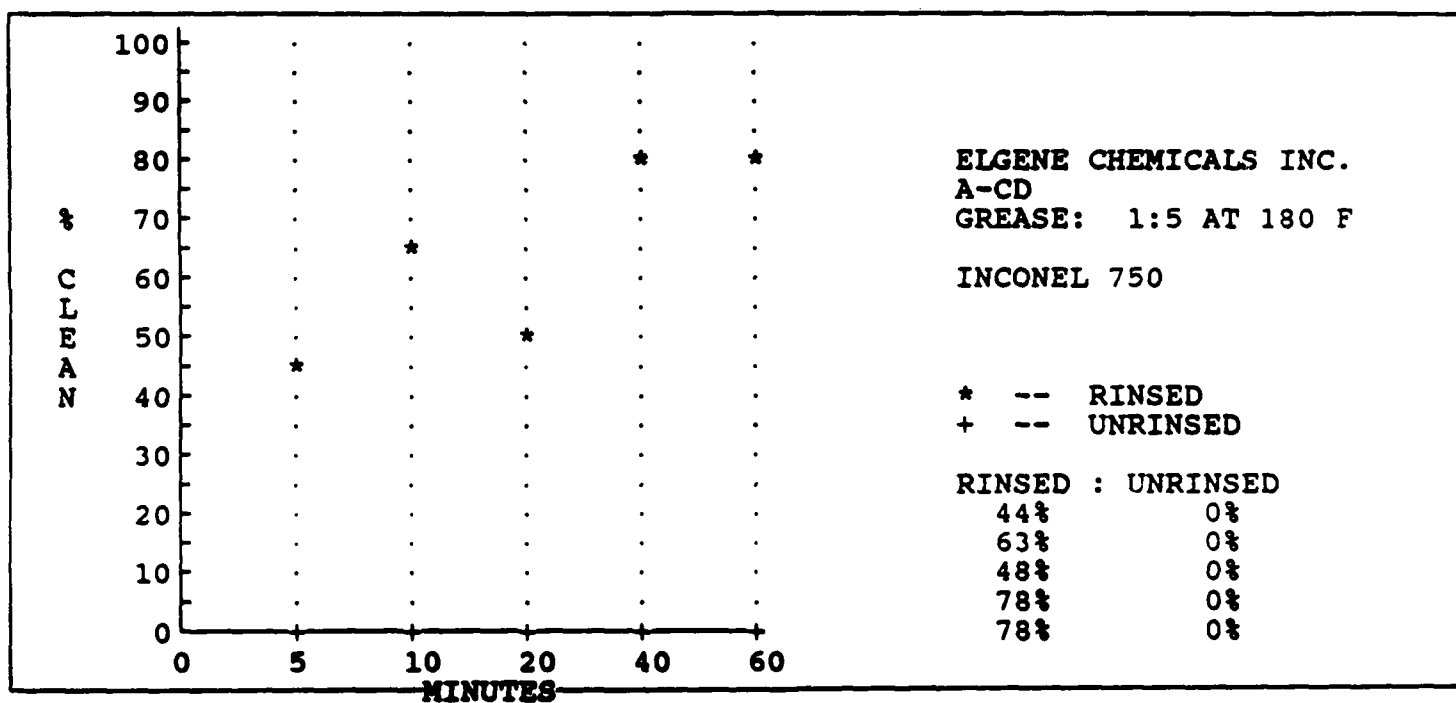
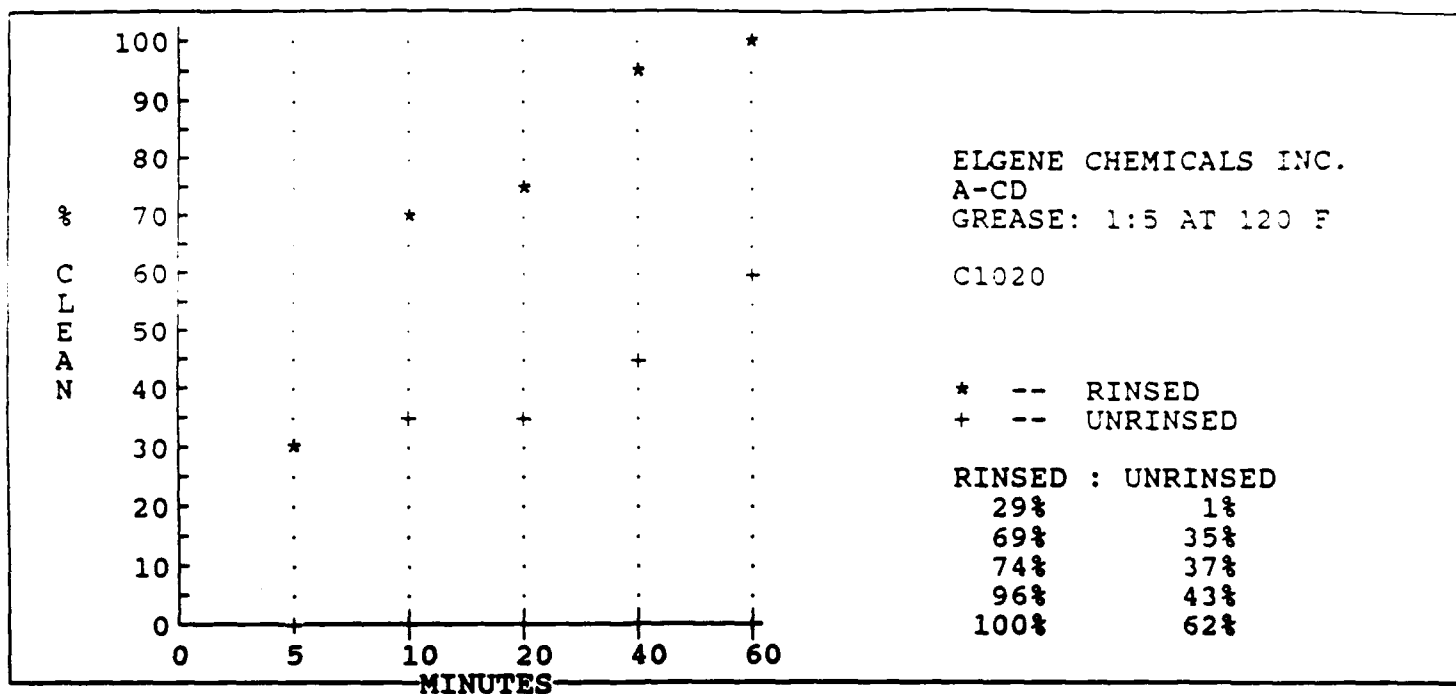


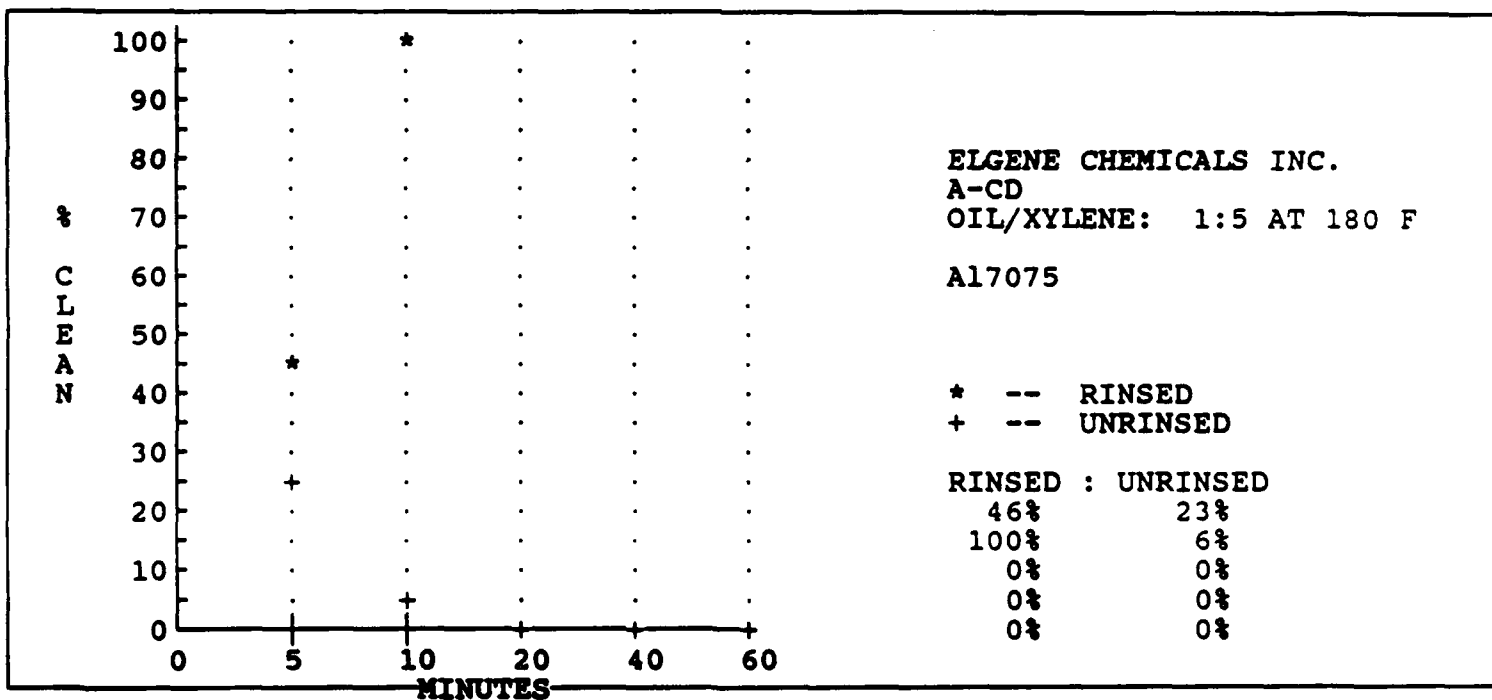
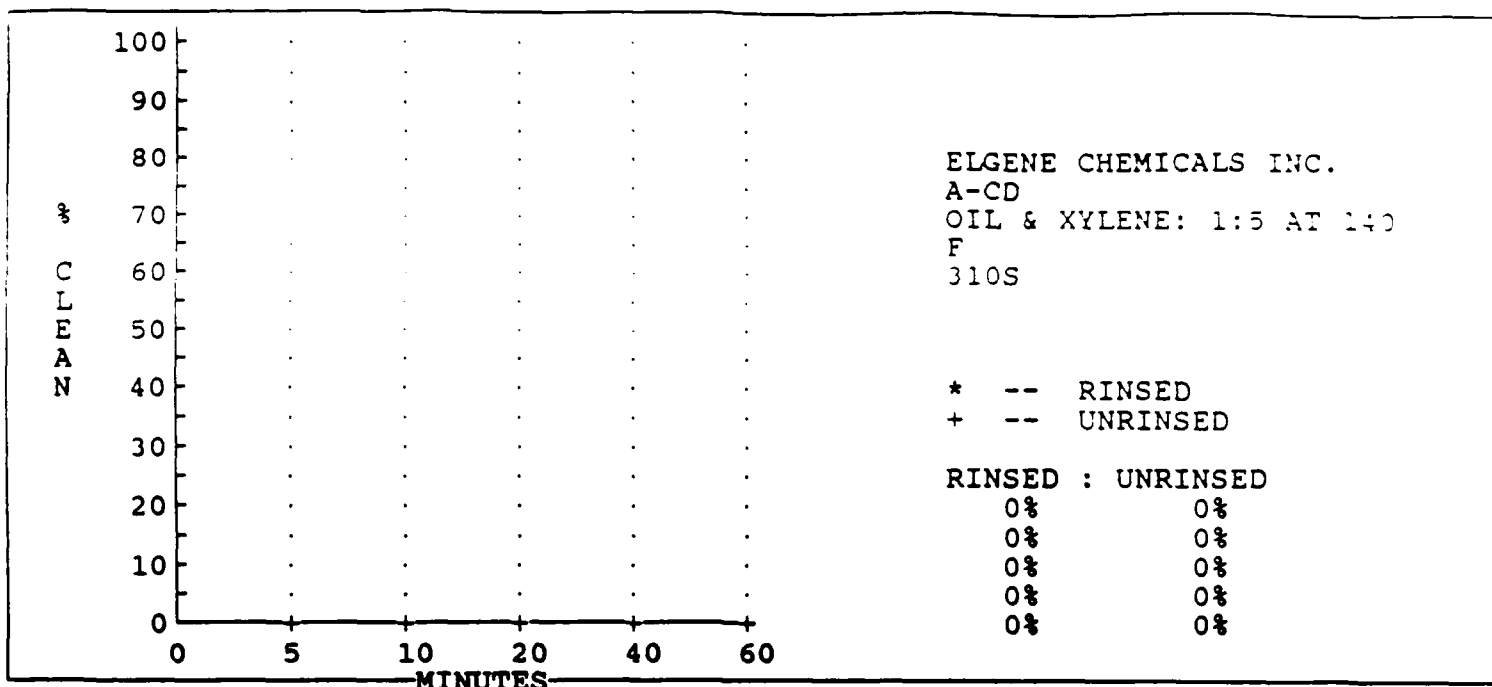


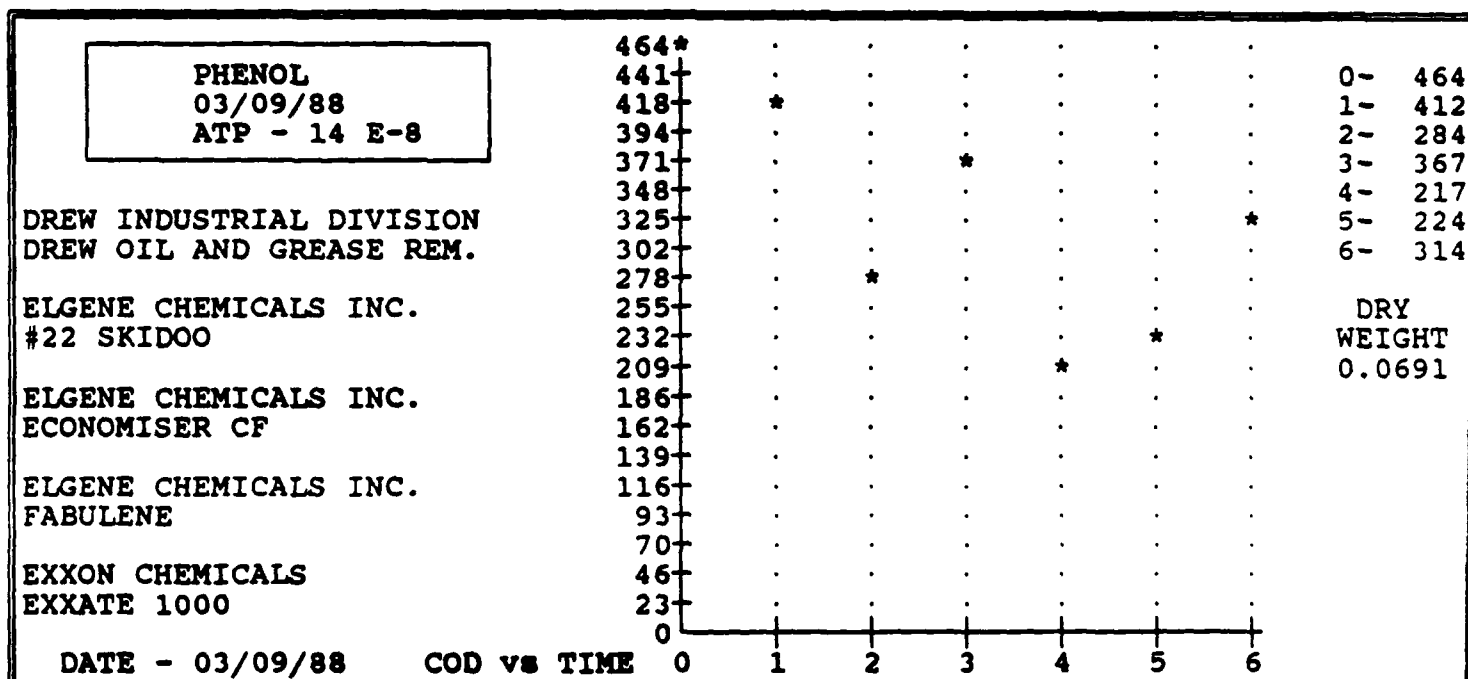
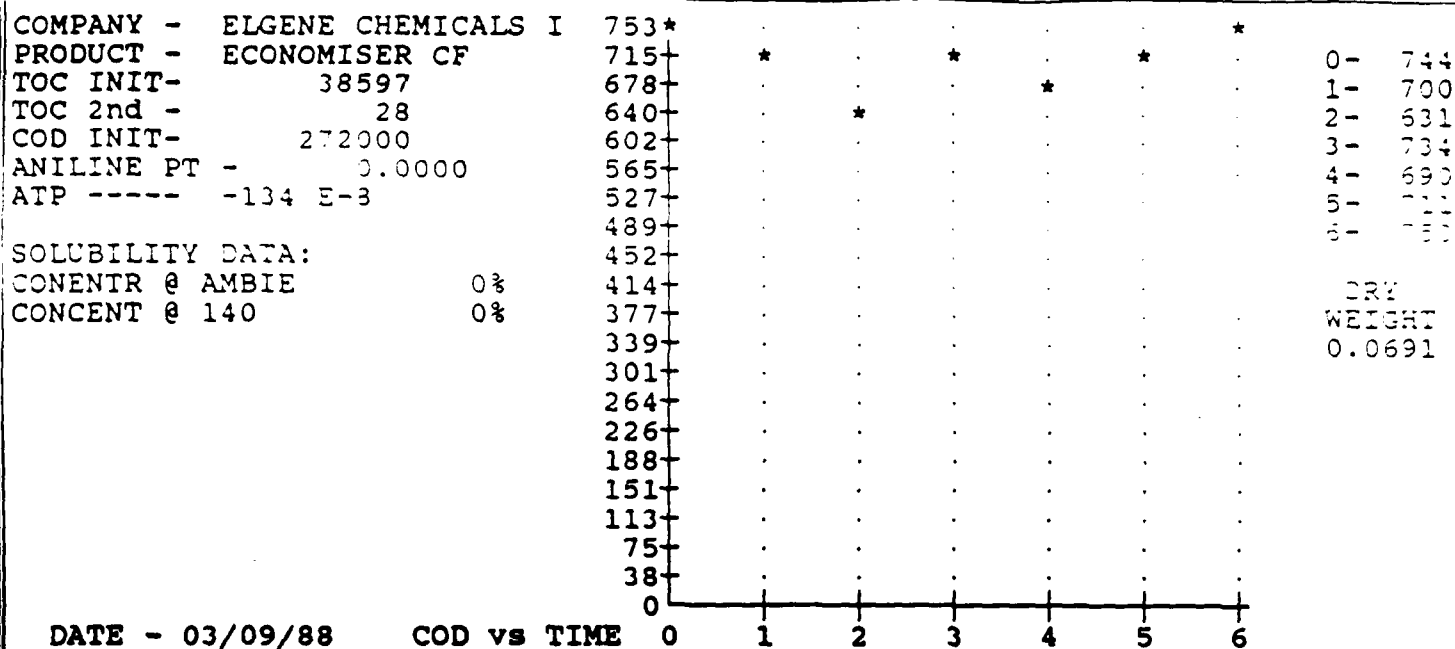


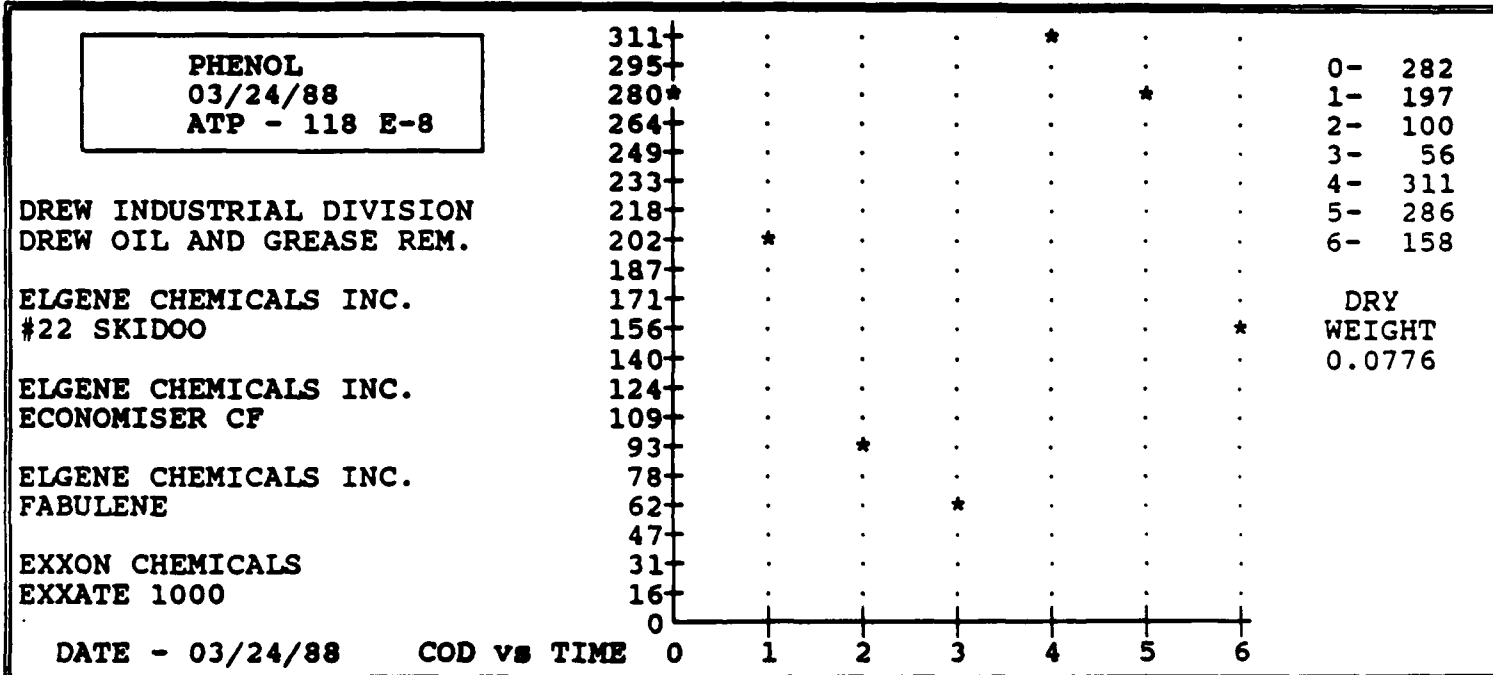
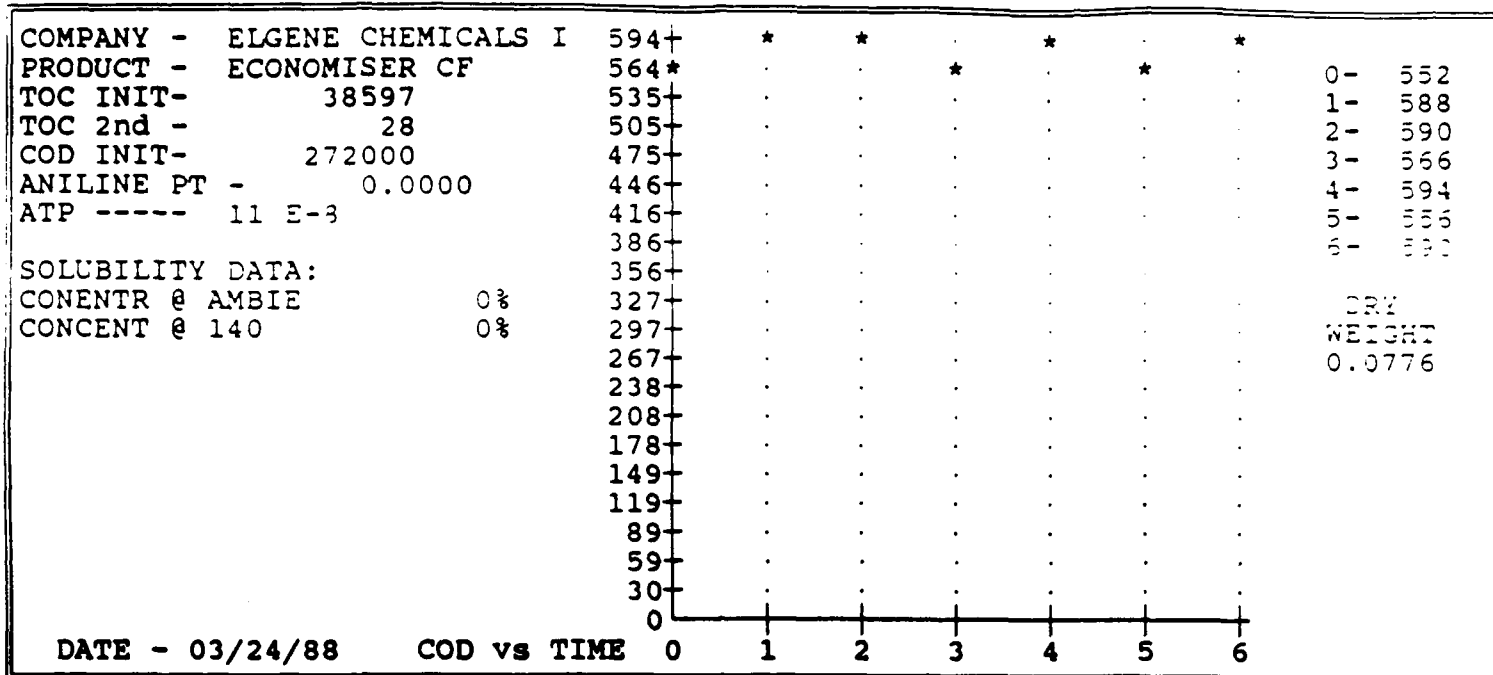


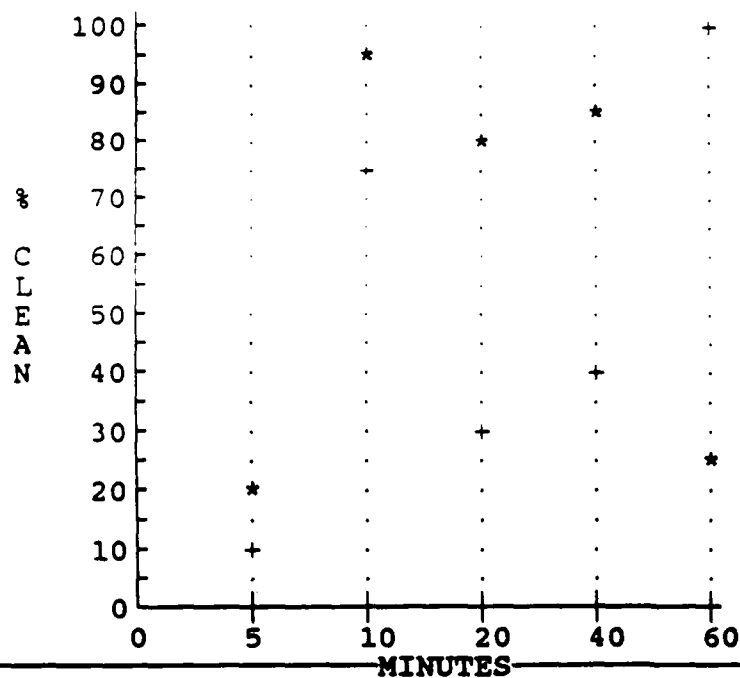








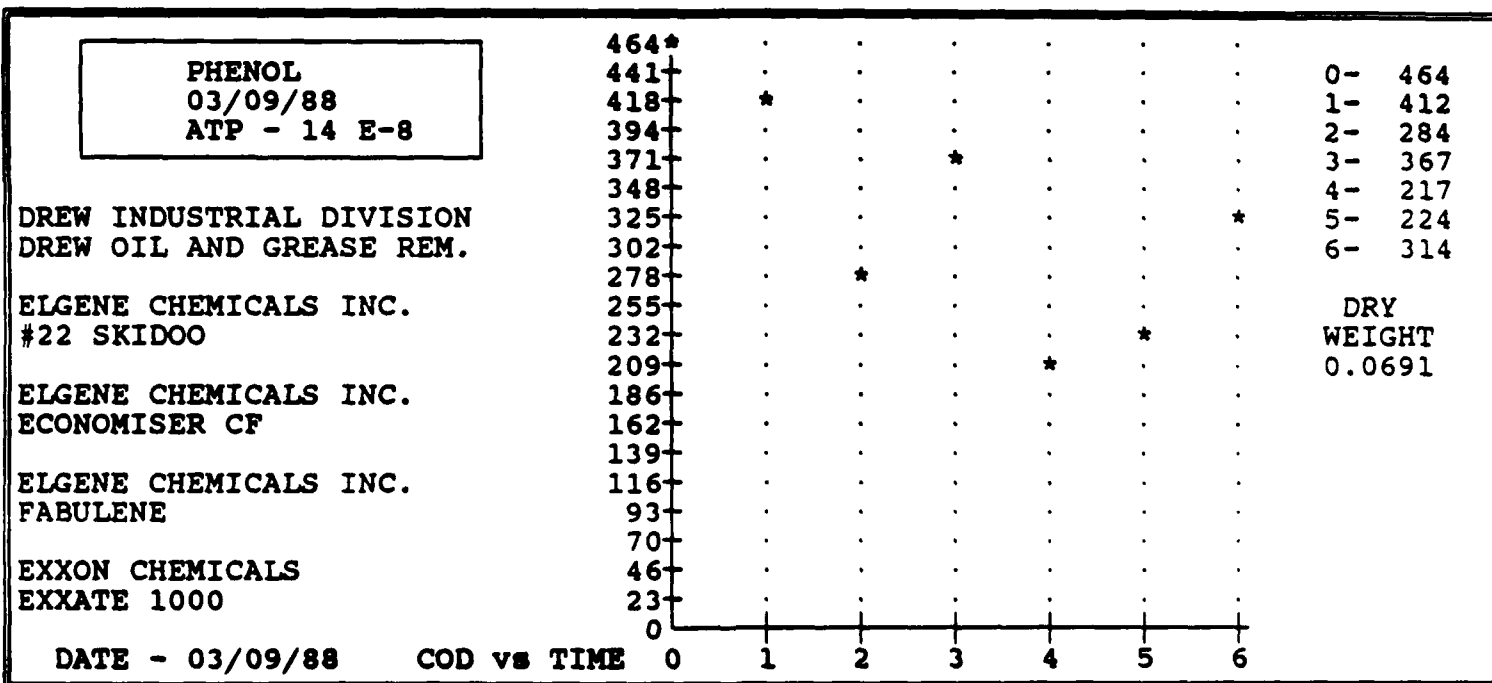
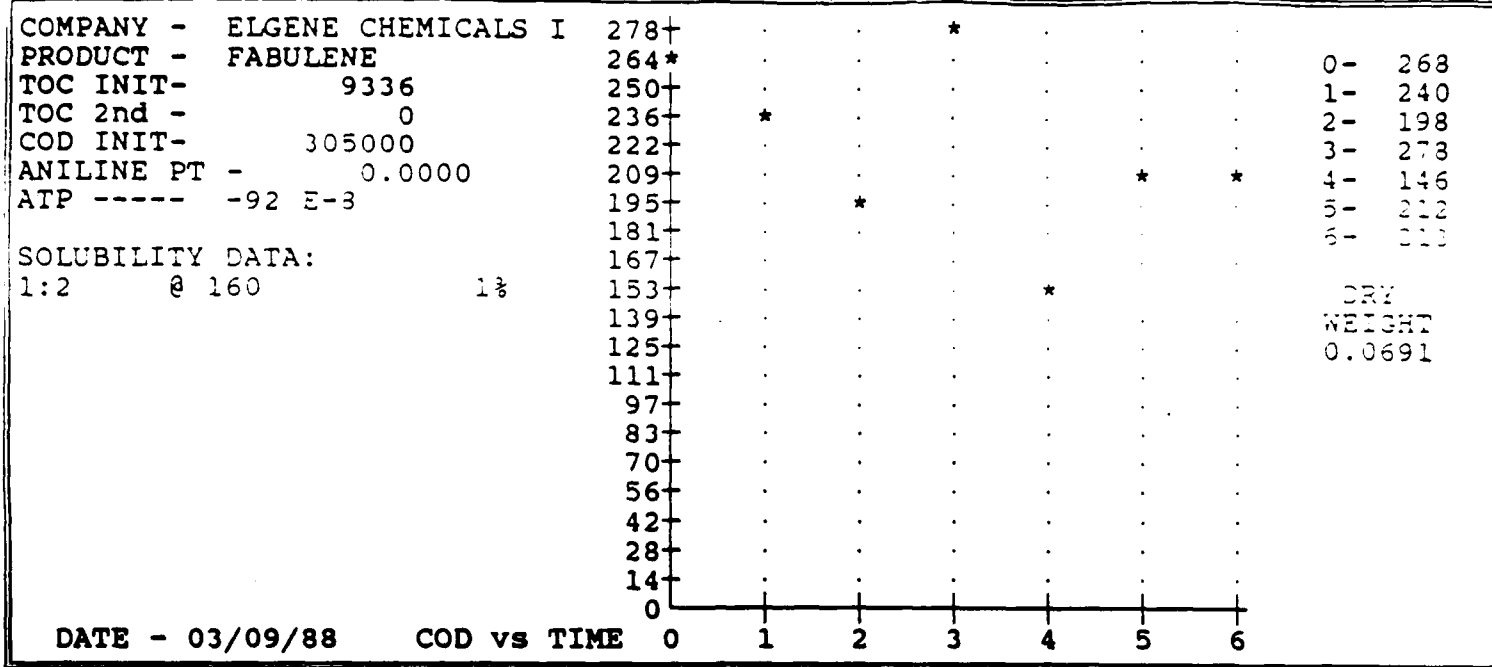


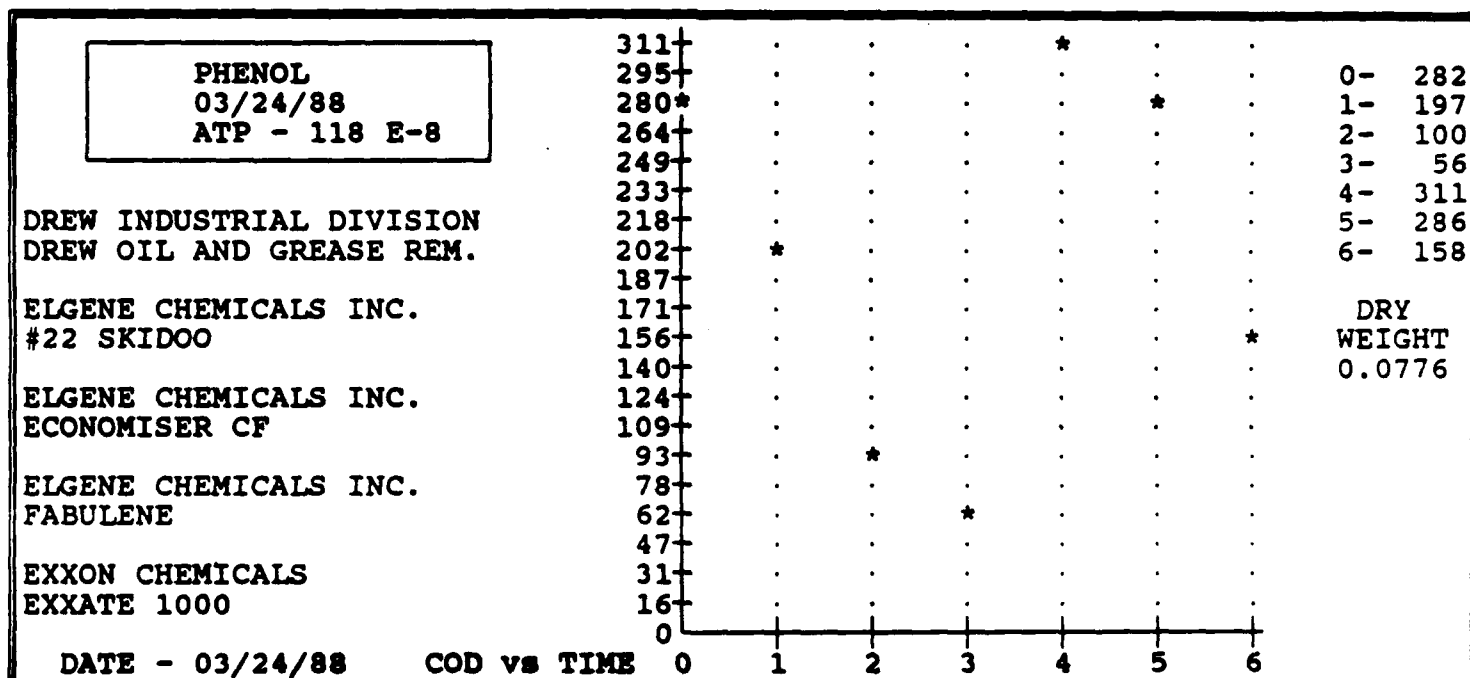
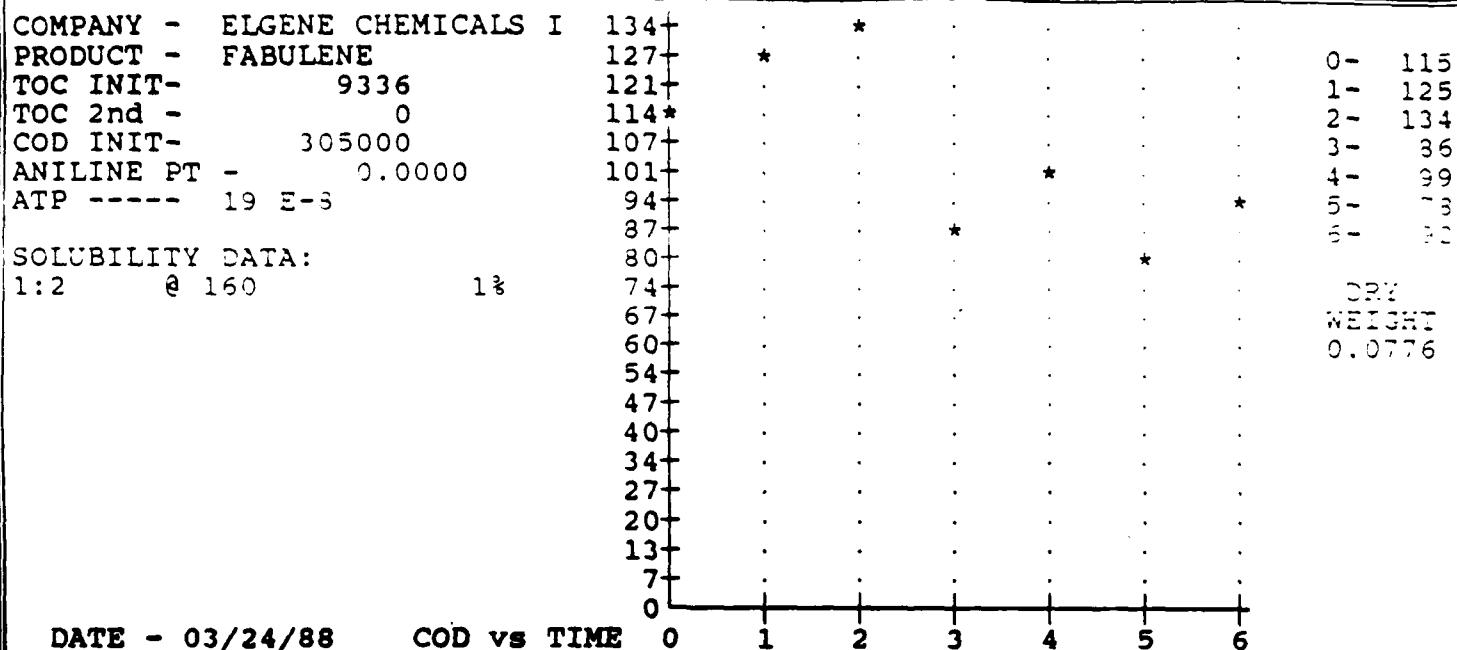


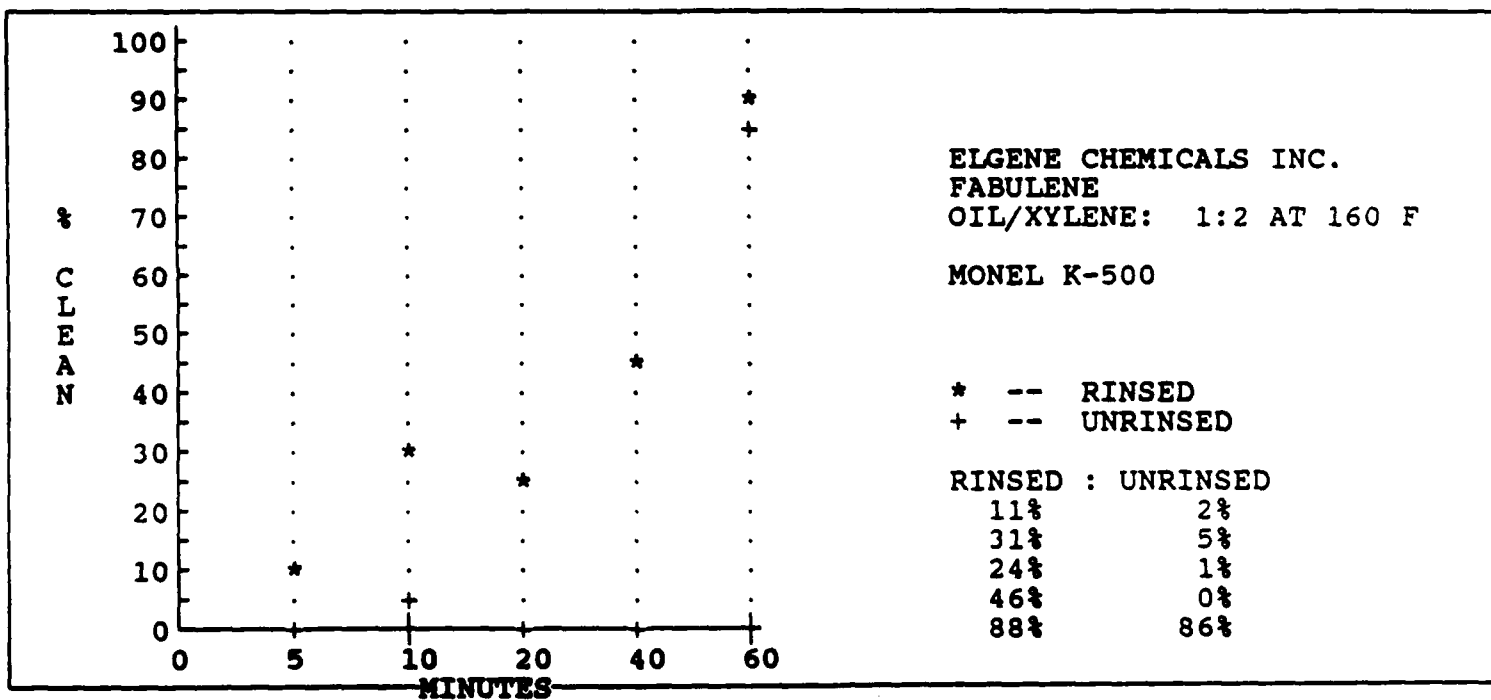
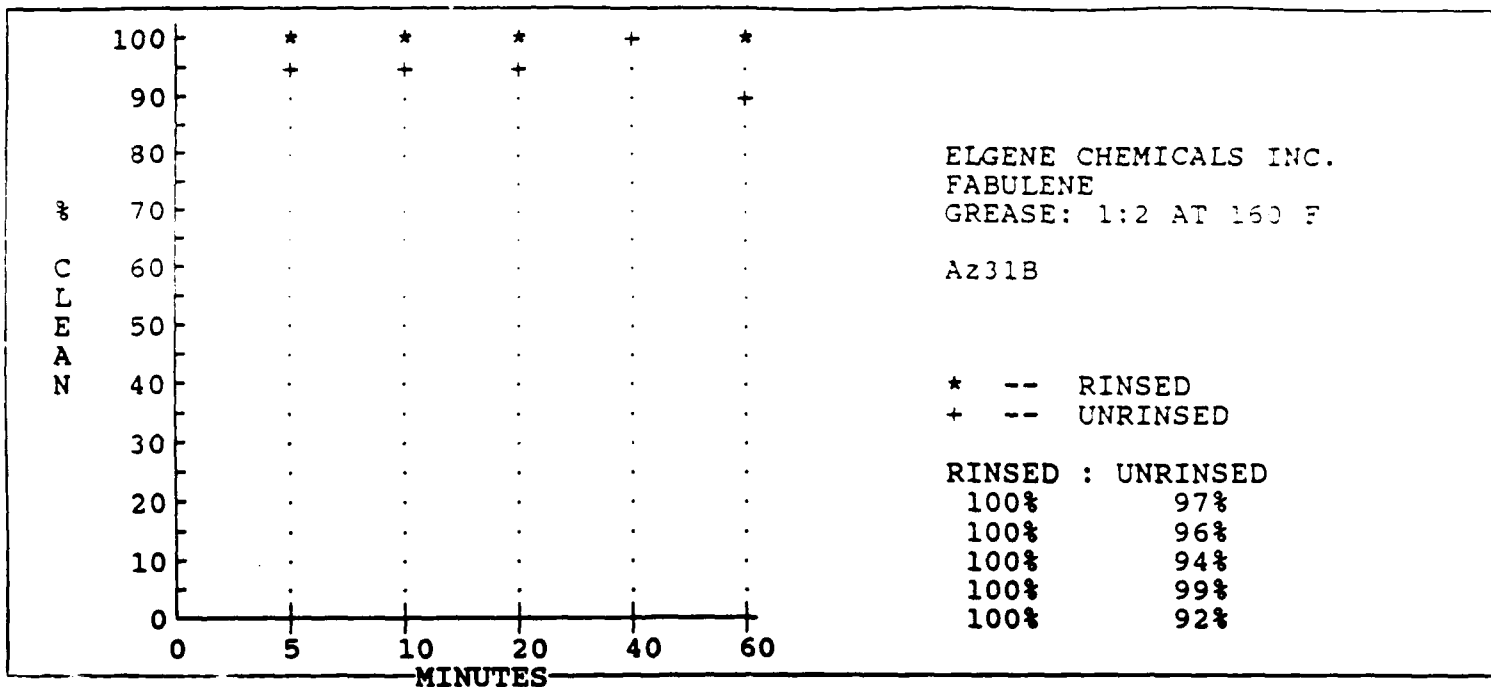
ELGENE CHEMICALS INC.
ECONOMISER CF
GREASE: 8 OZ/GAL AT AMBIE
NT
A231B

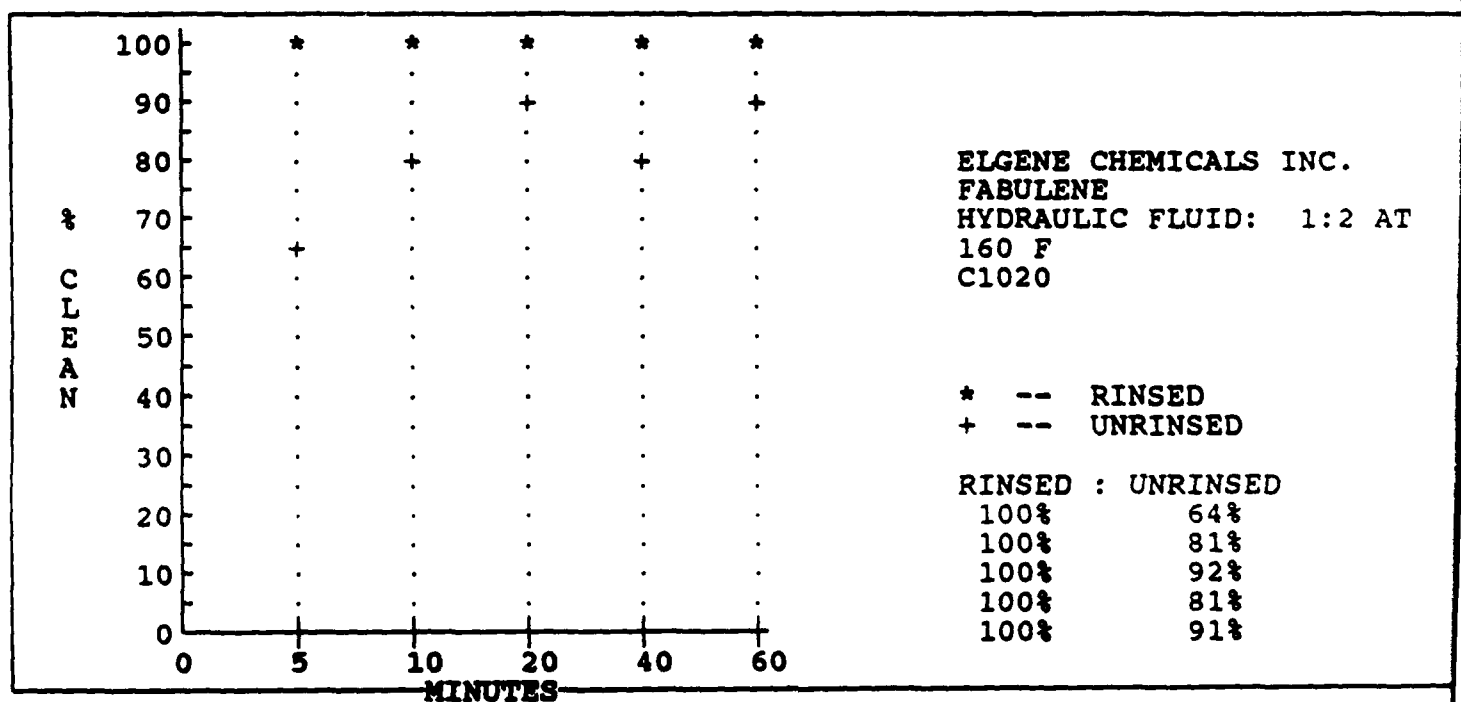
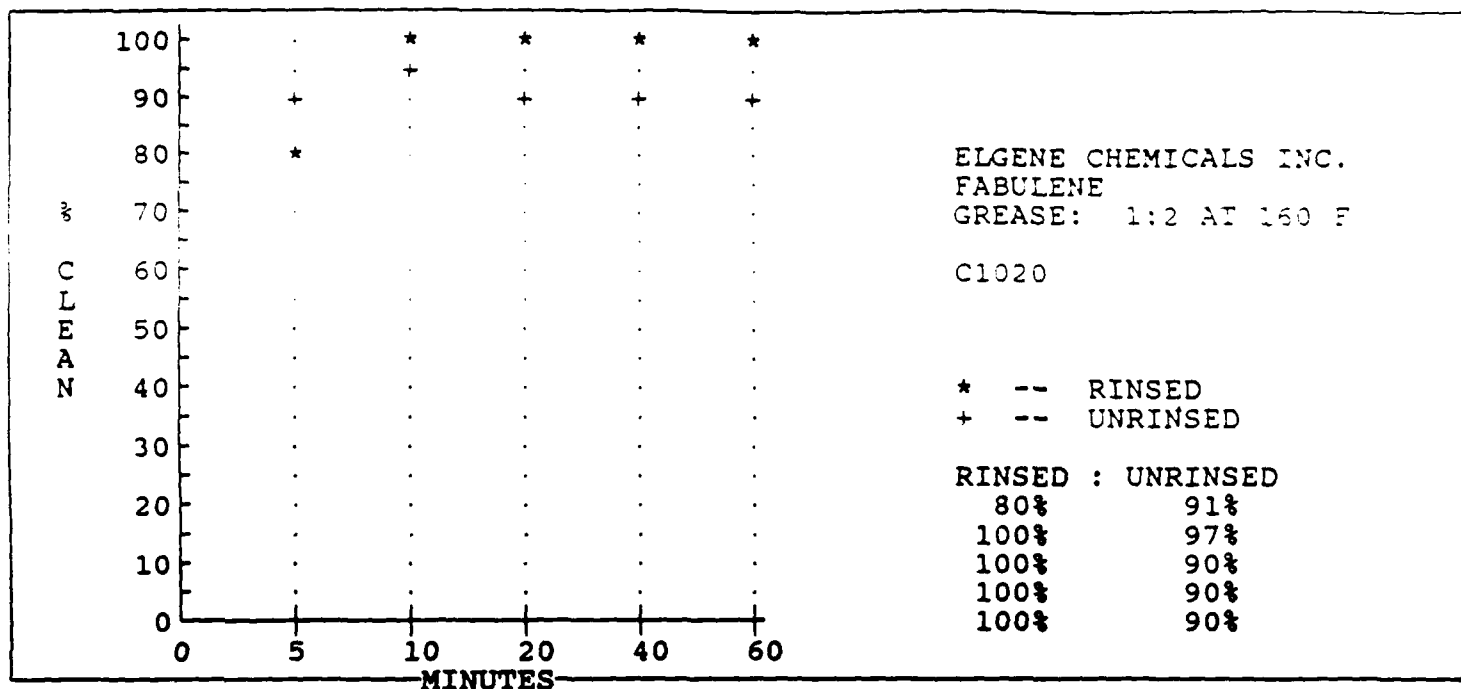
* -- RINSED
+ -- UNRINSED

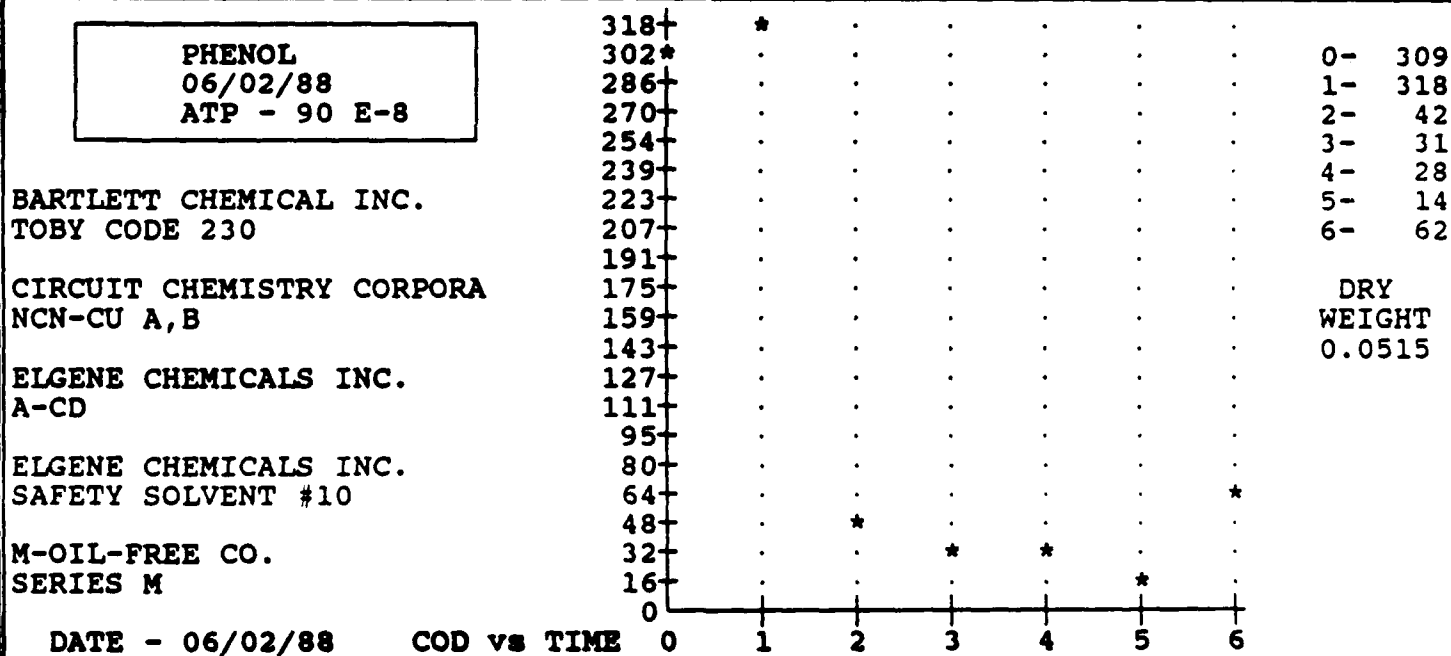
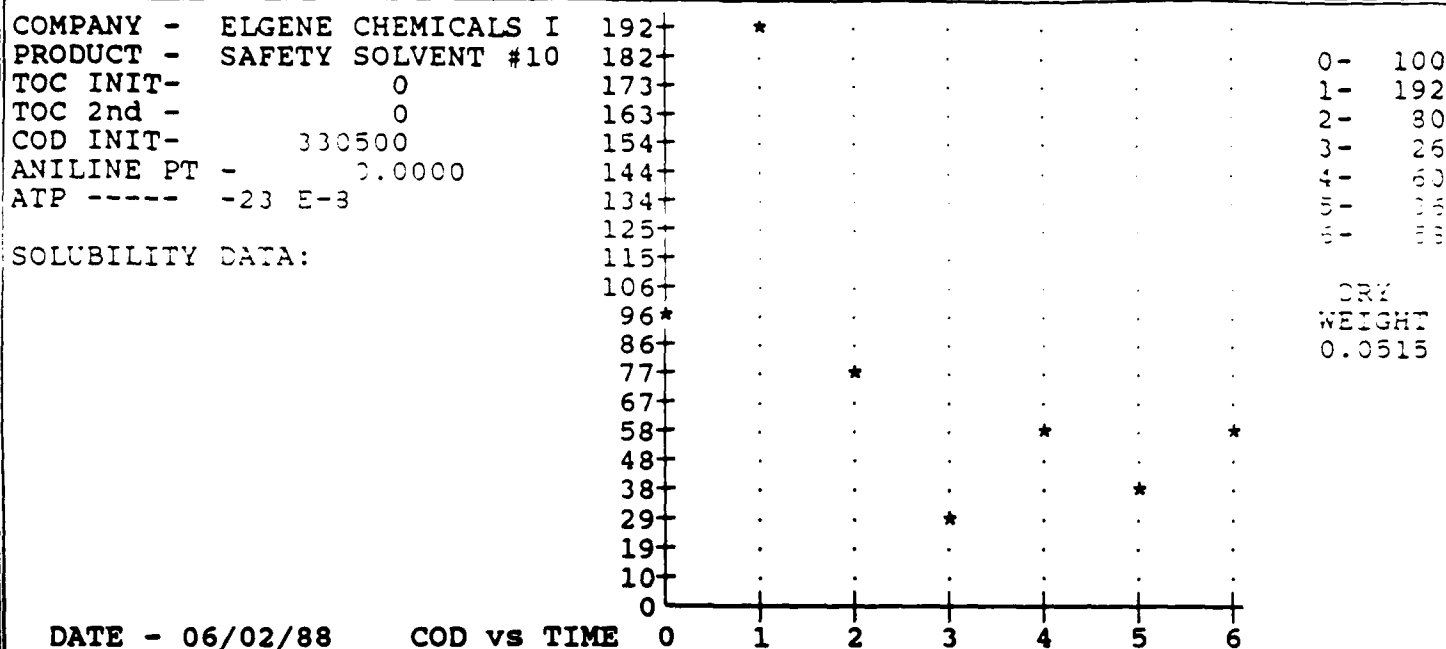
RINSED : UNRINSED	
21%	10%
96%	73%
81%	31%
84%	42%
26%	100%





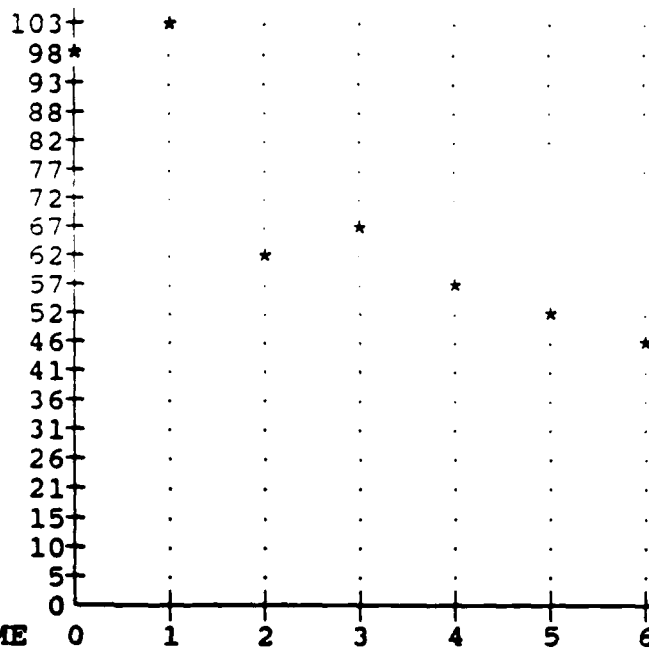






COMPANY - EXXON CHEMICALS
 PRODUCT - AROMATIC 150
 TOC INIT- 0
 TOC 2nd - 0
 COD INIT- 135500
 ANILINE PT - 0.0000
 ATP ----- 13 E-3

SOLUBILITY DATA:



0- 96
 1- 103
 2- 62
 3- 63
 4- 56
 5- 54
 6- 44

DRY
 WEIGHT
 0.0883

DATE - 06/16/88

COD vs TIME

PHENOL
 06/16/88
 ATP - 60 E-8

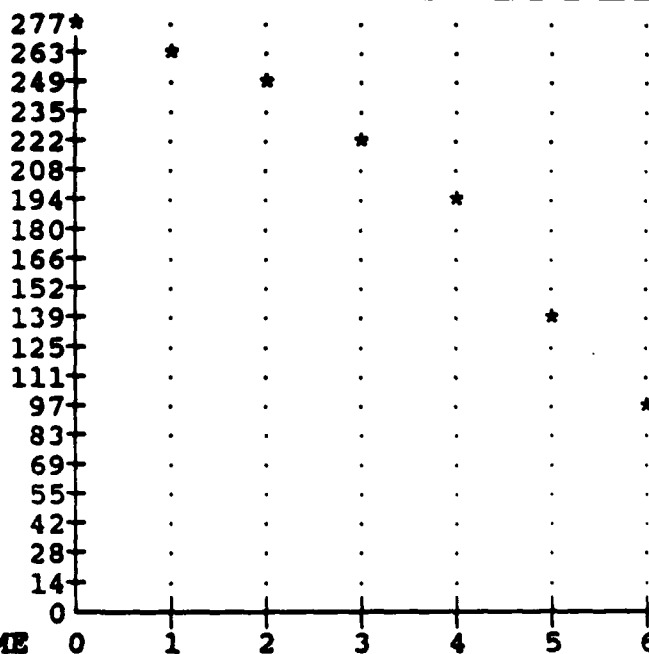
3 D INC.
 747 AIRCRAFT CLEANER

3 D INC.
 BRITE BOY

3 D INC.
 RUST ERADICATOR

CIRCUIT CHEMISTRY CORPORA
 METAL STRIPPER

EXXON CHEMICALS
 AROMATIC 150

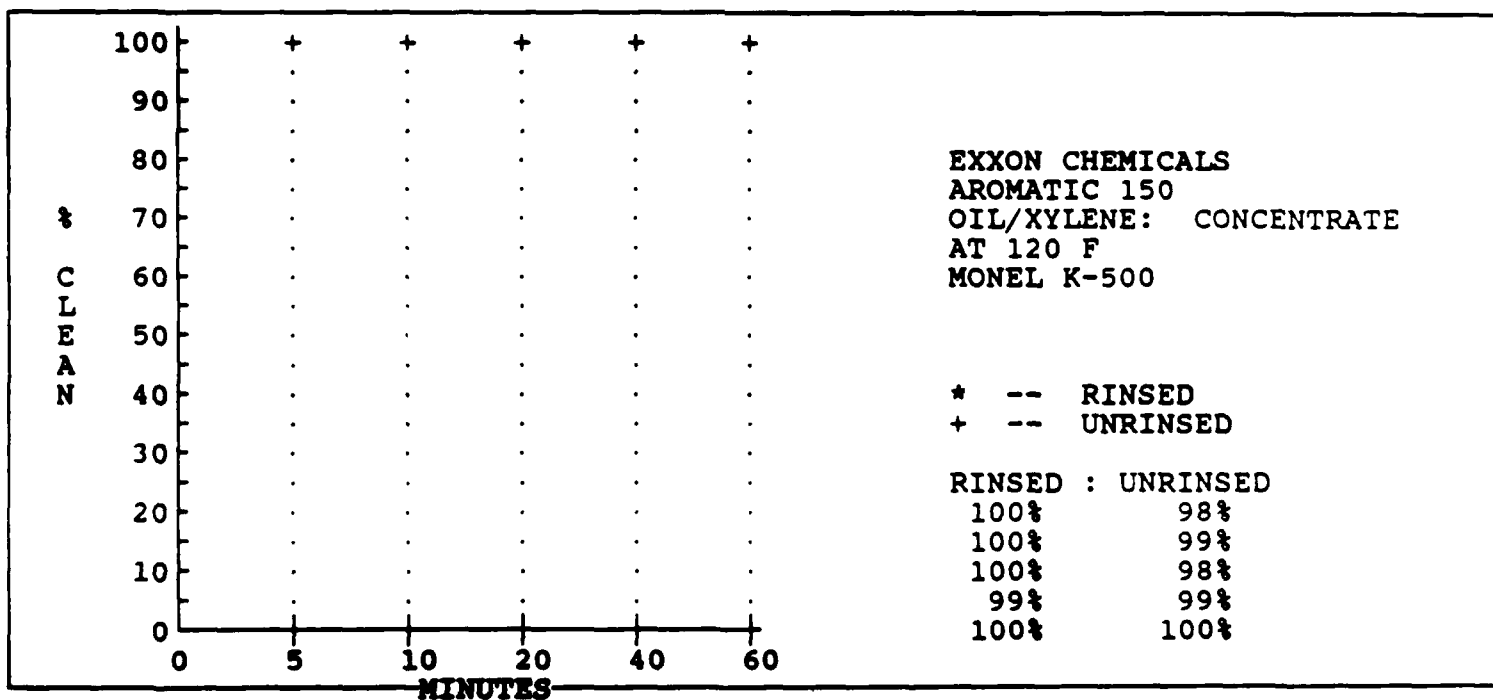
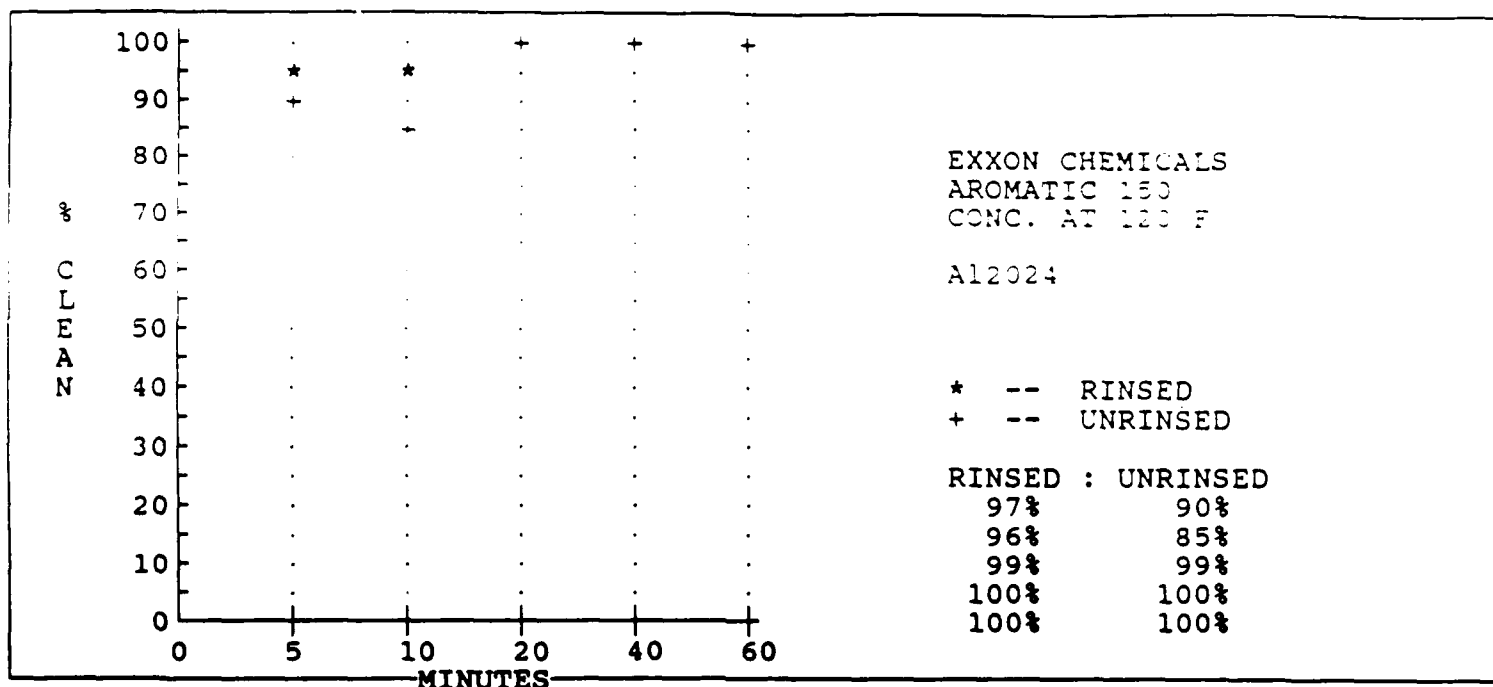


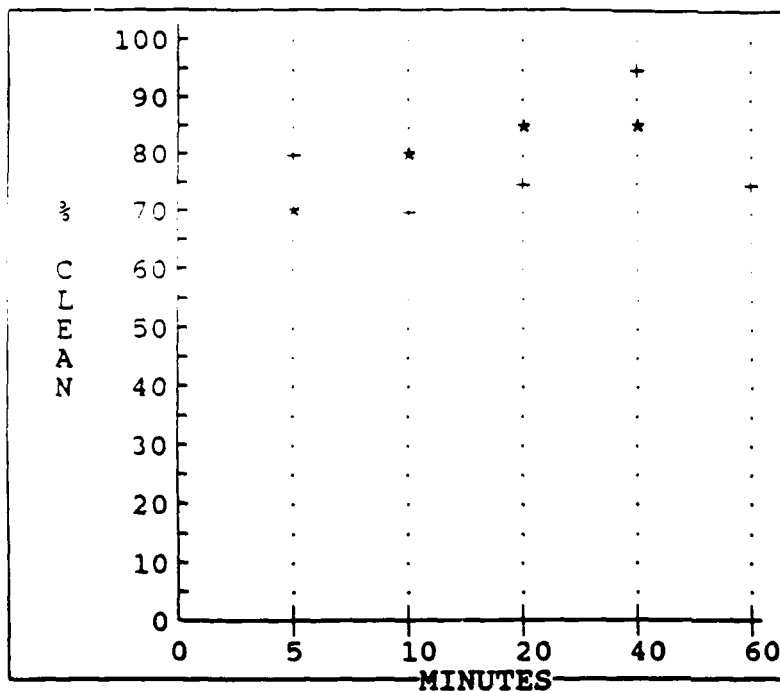
0- 277
 1- 266
 2- 245
 3- 218
 4- 196
 5- 140
 6- 102

DRY
 WEIGHT
 0.0883

DATE - 06/16/88

COD vs TIME

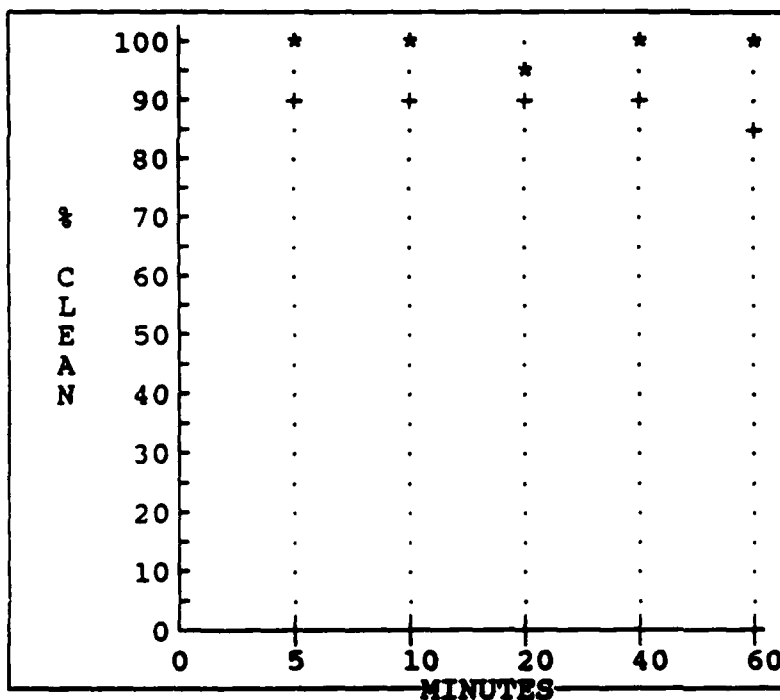




EXXON CHEMICALS
AROMATIC 150
GREASE: CONCENTRATE AT 1
20 F
INCONEL 750

* -- RINSED
+ -- UNRINSED

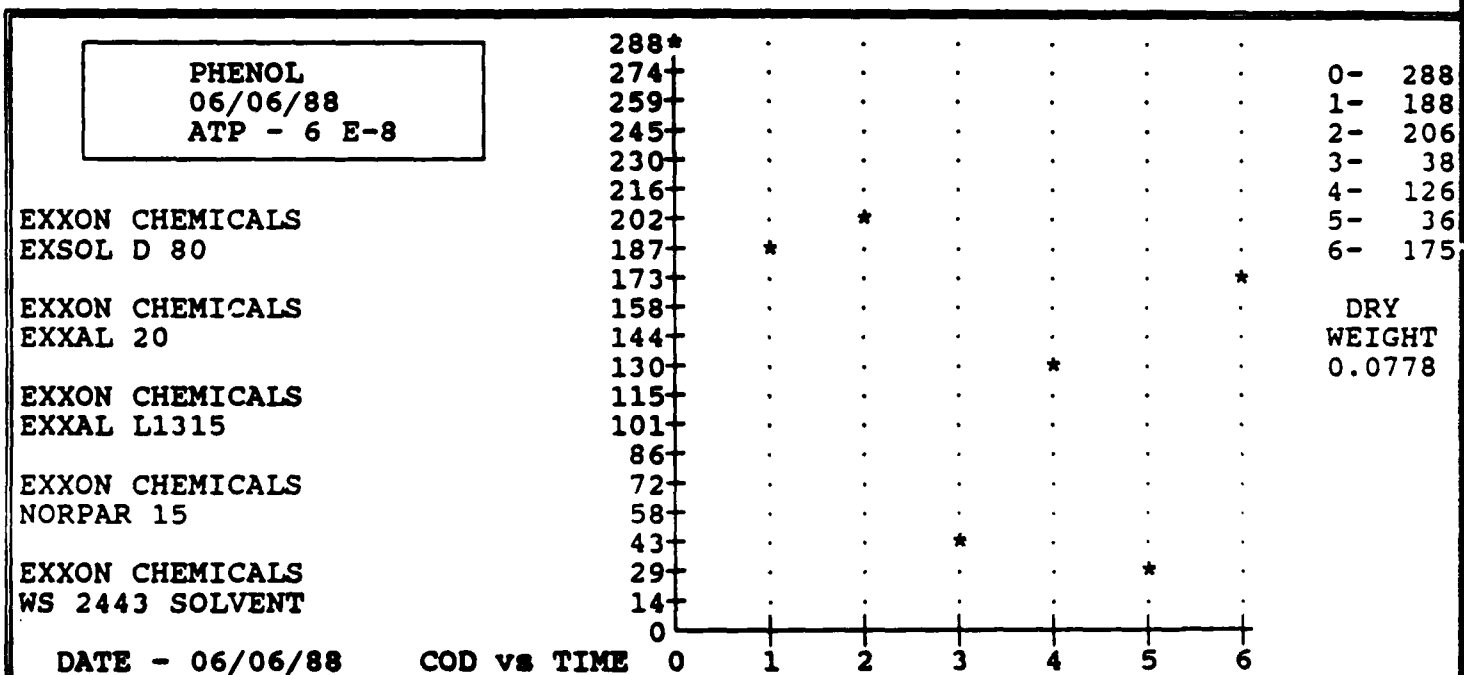
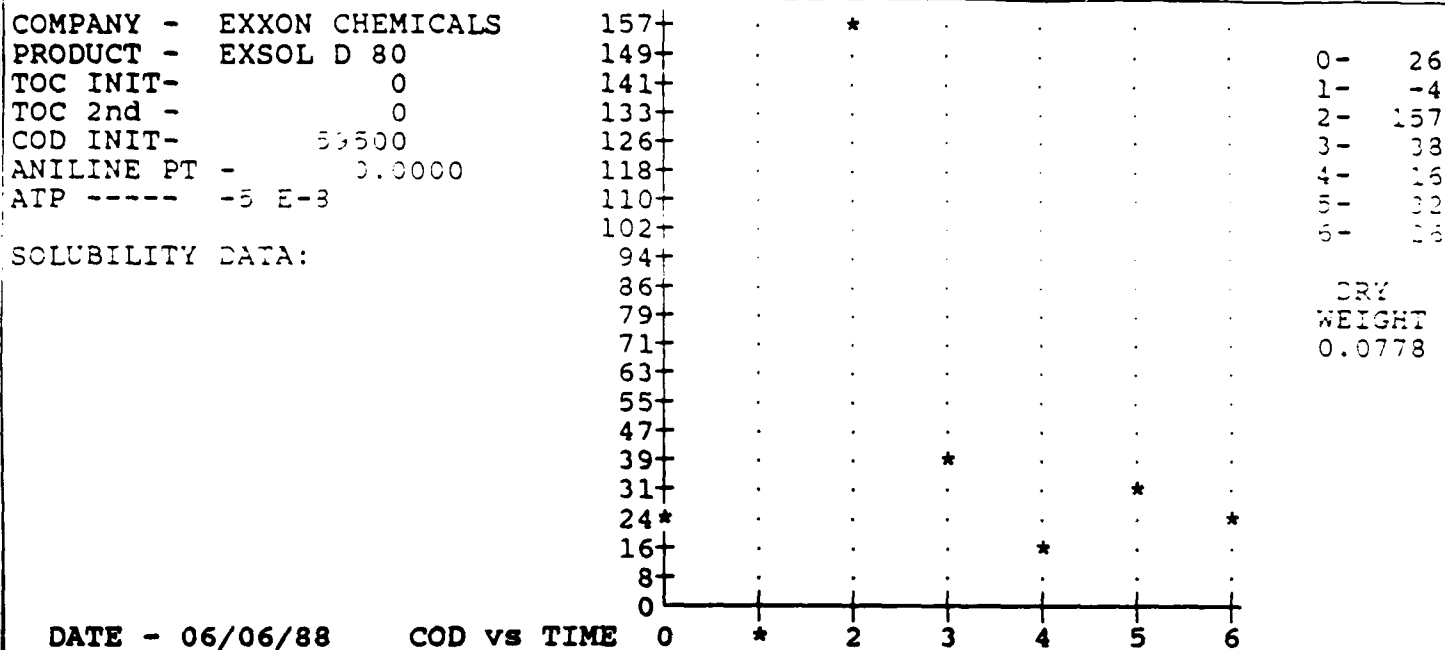
RINSED : UNRINSED	
72%	79%
82%	70%
83%	73%
83%	93%
76%	74%



EXXON CHEMICALS
AROMATIC 150
HYDRAULIC FLUID: CONCENT
RATE AT 120 F
Al2024

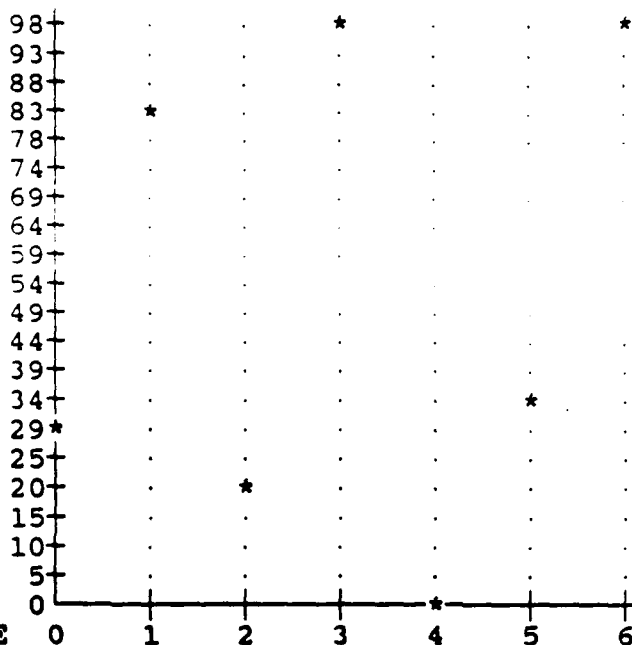
* -- RINSED
+ -- UNRINSED

RINSED : UNRINSED	
99%	89%
100%	92%
95%	92%
100%	90%
99%	85%



COMPANY - EXXON CHEMICALS
 PRODUCT - EXSOL D 80
 TOC INIT- 0
 TOC 2nd - 0
 COD INIT- 59500
 ANILINE PT - 0.0000
 ATP ----- 25 E-3

SOLUBILITY DATA:



0- 27
 1- 83
 2- 18
 3- 93
 4- -2
 5- 36
 6- 36

DRY
 WEIGHT
 0.0679

DATE - 09/28/88

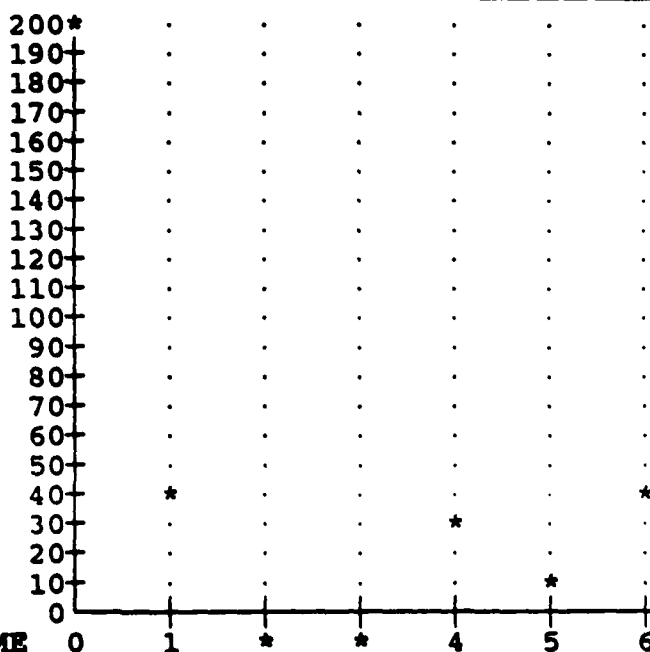
COD vs TIME

PHENOL
 09/28/88
 ATP - 65 E-8

EXXON CHEMICALS
 EXSOL D 80

EXXON CHEMICALS
 EXXAL 20

JOHNSON WAX/GEM STATE PAP
 BIG BARE



0- 200
 1- 41
 2- -25
 3- -25
 4- 27
 5- 14
 6- 38

DRY
 WEIGHT
 0.0679

DATE - 09/28/88

COD vs TIME

